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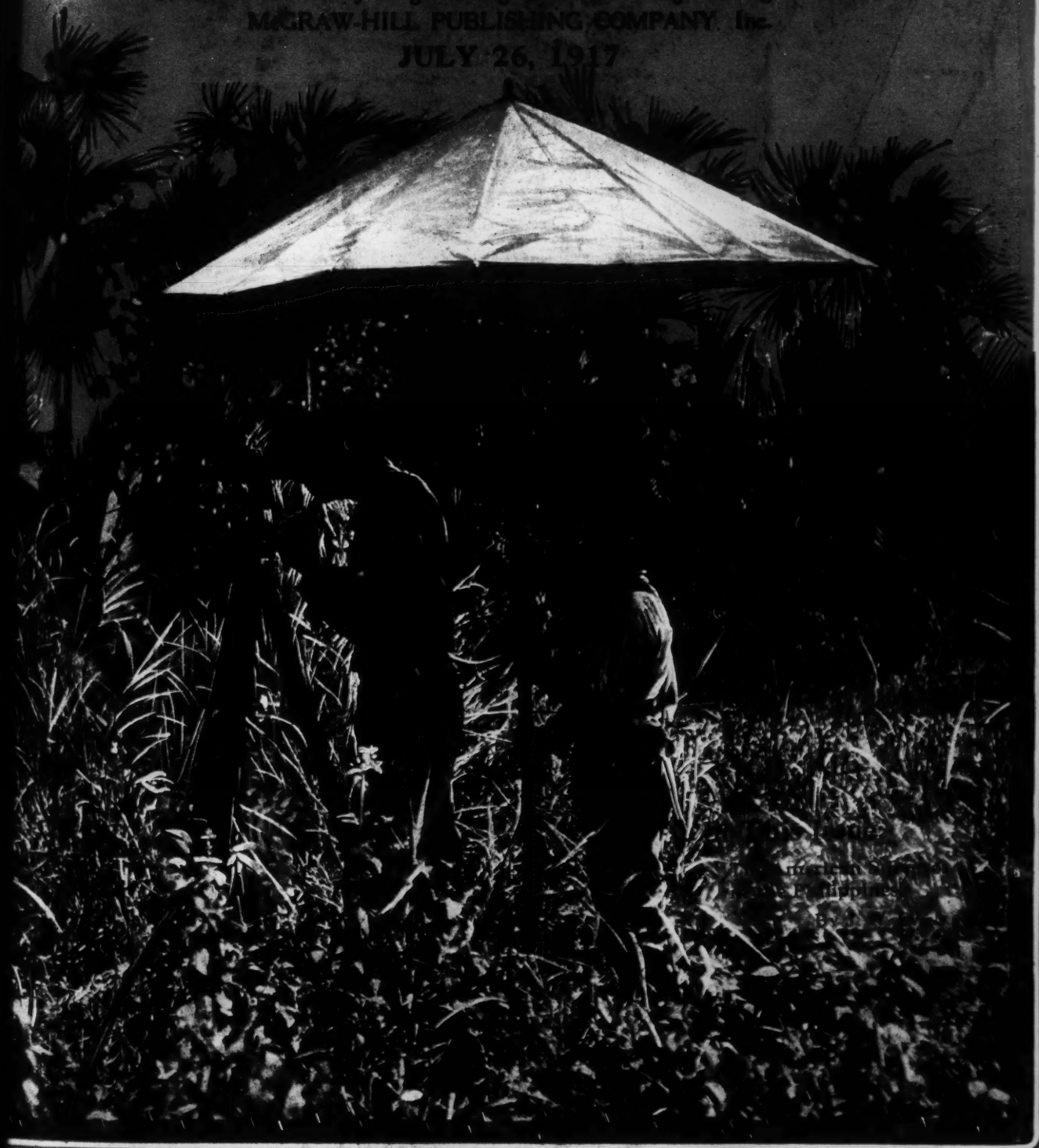

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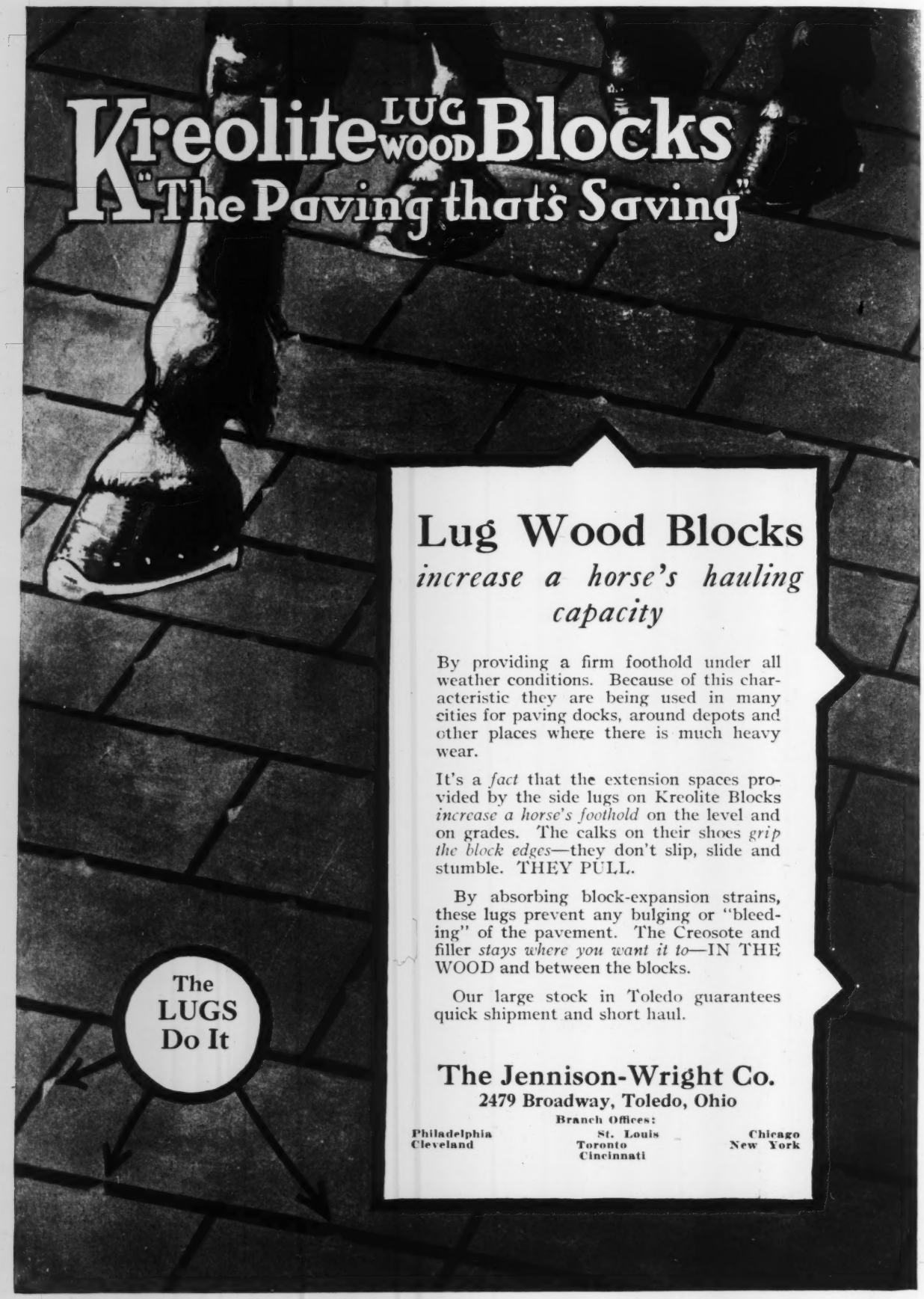

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
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The President Cuts the Gordian Knot

WHEREVER lay the merit in the controversy that has been delaying Federal shipbuilding, the President's decisive action of Tuesday will serve to clear the air. The mechanism which controlled the shipbuilding program was defective in that it permitted inharmonious personalities to retard progress. As each personality attracted to it some of those in partial control probably the only solution was to eliminate wholly one or the other side or to take the less decisive method of relieving both proponents of their responsibilities in the hope that the lesser elements could then find harmony in new chiefs. But the question of wooden or steel ships is yet unsettled, at least for the moment.

Coördination Saves Time and Money

VERY truthfully a Washington engineer remarks that the vast building operations of the Government lack efficiency because they are not coördinated under central control. It is universal experience that the absence of coördination in a large chain of interrelated enterprises brings with it many losses—time losses, or delays, and money losses, or excessive costs. Doubtless the former are the more serious just now; yet the money loss itself means further delay, since it makes more labor necessary to accomplish each single piece of work and thereby further sharpens the acutely unsatisfactory labor situation. We are bound to join most earnestly, therefore, in our correspondent's demand that coördination of the big construction program be brought about at once.

Form a Departmental Building Committee!

THE departments at Washington have shown such strength under the prodigious burden of work and responsibility of the past four months that nothing more is needed to demonstrate their resources in brains and managerial ability. The strong, level-headed men in the departments can handle the job of coördinating the national building program just as efficiently as they now handle the work of their own departments. Why are they not brought together for the purpose? *Engineering News-Record* urges the immediate need for such action by the administrative powers at Washington. Let the powers choose a group of department officers whose forcefulness is known from the way they have pushed their own work through. Make these men a steering committee clothed with plenary powers over the building construction now in progress and soon to be started. Place War and Navy men at the head—for the business all serves our fighting needs, needs military and naval. Such a committee will guide the erection of barracks, flying sheds, hospitals and warehouses with maximum speed and with greatest effectiveness.

When Public Work Is Not Public Work

THE decision of Judge Dowling, reported in the news section of this issue, will force, if sustained and followed to its logical conclusion, a readjustment of the conduct of all public work. Temporary interference with the rights of light, air and access to private property by the prosecution of public work has always been understood to be a cost that must be borne by the property owner affected. The decision rendered has cast a doubt on this precedent by holding that work carried out by a city for commercial purposes is not public work. How would a city-owned water-works be regarded in this light? Moreover, the cost of these damages, which may run very high, is saddled on contractors who have carried out the work in good faith. The decision rests on the Joralemon St. cases, where the damage to houses which settled from subway construction was a real and permanent damage, however temporary its cause. The firm of lawyers which has brought this suit is preparing a host of others. The city, apparently confident that the contractors would win in the higher courts, has refused to join in defending the cases, though, should the contractors lose, it is likely that the city would have to pay. That these suits may result in a final court decision virtually overthrowing established practice is a matter of anxiety to all connected with public work. Contract work would be placed under a discouraging handicap. We sincerely hope, therefore, that the Court of Appeals may take a different view from that held by Judge Dowling.

Garabed T. K. Giragossian

IT IS ALMOST certain that the Senate and House will be held up through the necessity of considering a joint resolution "For the purpose of promoting effi-

ciency, for the utilization of the resources and industries of the United States, for lessening the expenses of the war, and restoring the loss caused by the war by providing for the employment of a discovery or invention called the 'Garabed,' claiming to make possible the the utilization of free energy," which resolution aims to give one Garabed T. K. Giragossian protection beyond that afforded by the Patent Office for the invention of a machine through which the universal tension may pour as "free energy." To the consideration of this resolution, the Committee on Patents gave a hearing, the reprint of which fills 25 pages, duodecimo, and the House and Senate are no doubt destined to spare many precious minutes.

It is true that Garabed's language is beautiful, enticing, persuasive—and convincing. He says, in his talk before the committee, "Now, there is prevailing a prejudice or conviction among a certain class to the fact that energy can be produced without expense. They say it is against the law of nature. But I tell you, sirs, there is no expense in the economy of nature in the production of energy."

It is certainly a pleasure to see a great man or mechanism stop and consider the rights or feelings of a smaller organism. The innate kindliness, the pregnant courtesy, the deep-rooted and obviously flourishing Christianity of the act compel attention and earn their own reward. It is of this quality that the softer side of life is composed. But unfortunately, Congress now has not much time to spare. Regrettable as it may actually be, our strength and attention are, and rightly should be, focused on placing the rifle in the hands of the National Army. But Congress has its own way, and it is "Business as usual."

Massachusetts Highway Engineers To Cut Cost of Roadwork

CONFIDENT in the belief that road-construction costs can be cut by abandoning the present standard methods of letting contracts to the low bidder, the Massachusetts State Highway Commission has begun pioneer experiments in picking out the best men and offering work on a cost-plus-a-profit basis. Details of these contracts are given elsewhere in this issue.

By the terms of these agreements the contractor is relieved of all gamble on labor and materials. The state takes care of paying the labor and furnishing the materials. The contractor's problem is to get the laborers and to supervise their work to the best advantage. For both these purposes, he is presumably better equipped than the State Highway Department with all its governmental red tape to unwind.

For each unit of work performed, the contractor receives an agreed-upon "profit"—that is, it would be profit if the labor costs were the only costs to be met. But there is the contractor's own services and the expenses of his organization, depreciation of his part of the plant and equipment, etc., to be taken into account. All these are smaller as the work is hastened and economically done. Hence is furnished a spur to much desired speed and efficiency

In the savings-sharing contract made with Daniel O'Connell Sons, of Holyoke, the state has assured itself of getting the work done at the low-bid price, but at the same time is giving the contractor every facility for dong the work to better advantage. If successful by these means in reducing the cost of the work, the state shares the savings equally with the contractor.

No claim is made for these contracts as cure-alls, or as the last word in highway construction methods. They are admittedly experiments, the profit in which remains to be demonstrated. All the same the responsible officials deserve high credit for courageously trying out a possible solution of the problem in the face of much opposition from some contractors and their political friends, who profess to believe that favoritism is shown in the awards.

The Barge Canal—Now or Never

THE New York State Barge Canal has been under construction for more than ten years. During that time the people of the state have been kept constantly informed, through the usual mediums of publicity (and more practically by occasional demands for more funds), of the progress of the work. Through this and through personal observation they should have been readily able to make a fair guess as to the time when they must be prepared to make use of the expensive transportation tool furnished by the state—that is, by themselves.

Have they done so? The almost empty canal system is the answer. Today the Barge Canal is in operation for full width and for 8 ft. depth (which will be 12 ft. by Aug. 1, when a few shoals are cleared away) from Lake Ontario at Oswego to tidewater and from Lake Champlain down to the Hudson. Between Buffalo and Rome, where there is still enough work to postpone the opening of the new line until next spring, the old Erie canal with 6½ ft. depth is available. The Welland Canal makes possible the early transport of barges or ships up to 10 ft. draft and 43 ft. beam from Buffalo to Oswego, and with the Barge Canal establishes complete connection from the Great Lakes to tidewater for large freight barges.

So far as can be learned, there is no effort to build ships or barges for such travel or to organize the control or shipment of freight. Rumors of a seaworthy vessel so large that it just clears the Barge Canal structures are abroad, and some of the manufacturing companies along the route are considering plans for waterway freight carriage. But for the most part the shipper and manufacturer who are supposed to profit by the lower canal rates are quite ignorant of the possibilities of the waterway as a rival of the railroad.

The New York State Barge Canal has practically left the hands of the State Engineer. By next season at the latest he will have turned it over to another branch of the state service to operate. Its immediate future is in

the control of the publicity man. Having spent one hundred and fifty millions to open a fairly deep and wide waterway across its territory, the State of New York must now spend a considerable sum in letting its people know that such a waterway exists, in informing the cities so that the terminals may be made approachable, in promoting the organization of shipping companies by whose operations freight may have a prompt passage, and in guaranteeing to the shipper as thorough a control of his goods as he now obtains from the privately owned railway.

Fortunately the state is taking a step, somewhat belated though it is, toward that end. A traffic manager for the canals has been appointed. It will be his duty to undertake the various publicity activities outlined in the previous paragraph and to try and build up for his water-road as good a service as any freight traffic manager attempts for his railroad.

The state—and the long-time advocates of the canal—are fortunate, too, in the time when they start such work. If ever a canal could succeed, here is that canal. Railroad coöperation is promised, through way bills are guaranteed by recent state and Federal legislation, Public Service Commission control is established, and the Federal Government is offering its great powers of coöperation.

Were it not for the war-awakened disposition of the American people, the prospect for the canal would be most discouraging, for the lethargy that permits the present unpreparedness for waterway service in New York would seem to be unsurmountable. But the war is a huge motor which is driving men's minds and activities into new and hitherto unsought fields, so that the state's campaign for its freight carrier may have an audience receptive to a degree unhoped for a year or two ago.

The coming two years ought to make or break the canal as a modern transportation unit. If present conditions do not rouse the citizens of New York to its use, there is small hope for its future.

Two More Engineer Victims of City Misgovernment

THE life of the engineer in city employ has not been falling altogether in pleasant places of late. On June 25 the City Council of Portsmouth, Va., dismissed the city manager, and three weeks later the Board of Public Works of Los Angeles declared the office of city engineer vacant. In each case the action seems to have been unwarranted and unjust. In each case the information at hand indicates that the city would have been better served if the council and the board respectively had been put out of office instead of the city manager and the city engineer.

At Portsmouth there is strong evidence that the council muddled city affairs by usurping the executive functions which the statute specifically excluded it from and vested in the city manager, and that it failed to give its new city manager time to show what he could do or credit for what he accomplished in a few months under heavy handicaps.

At Los Angeles an able city engineer, of high integrity and of long service at a modest salary, appears to have been sacrificed because of his unswerving devotion to the interests of the city and its taxpayers. It has been a long, hard fight for Mr. Hamlin, under an antiquated city charter and conflicting legislative and administrative bodies on the one hand, and on the other under an electorate desiring all sorts of innovations but unable after repeated attempts at charter revision to agree on any unified system of municipal government.

In both cities the ultimate responsibility rests upon the citizens and voters who fail to protect their own interests in casting their votes for elective officers and to hold these officers and their appointees responsible for the conduct or misconduct of city affairs.

Why Can't the Railroads Check the Hobo?

ONE of the greatest sources of trouble at present with the labor supply on construction work is the hobo, according to influential contractors who expressed their opinions in the June 28 issue. With the foreign supply greatly diminished and the intelligent skilled and semi-skilled workmen attracted to other fields by higher pay, the hobo reigns supreme. One contractor hires him by the hundred at some labor center, takes him to the job and keeps him there—until he earns a "stake." Next week the hobo is back in town, his stake spent on a periodic jag, ready to ship out again and run up the cost of some other contractor's work. Those who doubt the present extent of this practice need only read in the article on page 651, issue of June 28, some of the figures of the average length of employment. The hobo travels by rail. Walking is beneath him and would never permit the run of the wide range of territory he covers. The contractor must pay his way in one direction, but the hobo himself never parts with money for carfare except in petty sums, as "graft" to freight-train crews. Consequently, on the return trip he "beats it." Were it not for the universal custom on American railways of permitting such travel, the hobo element could never have developed. Were the practice stopped now, this element could no longer operate. Having reached the job, the hobo would be compelled to stay there at least until he had cleared return carfare in addition to a "stake" meeting his ideas of the proper proportions for a spree. In most cases this would mean more than a month, contrasted with the few days averaged by most of this element at present. The practice of allowing these men to steal rides is supposedly proscribed already. Cannot the railroads induce their train crews to tighten up on this matter, at least while the need for steadying down the hobo element and inducing it to do a little useful work is so crying? What has the commission headed by Daniel Willard to say on this point, which is certainly within its scope?

Cleveland Subway Cuts Sheeted with Round Piles

Run Motor Trucks Through Excavation and Load Them by Steam Shovel on East End, Use Cranes and Portable Hoppers on West Approaches

BECAUSE prices were high and no deliveries of steel sheet piling could be promised, the contractor for the subway approaches to the Detroit Superior viaduct in Cleveland has used round piles and scrap plank for sheeting in dry sand soil with complete success. For excavating the four-track cut at the east end, motor trucks are run through the cut and loaded by a revolving shovel. At the west end, where the two 2-track approaches are not wide enough to allow this, a locomotive crane and traveler derrick loading into hoppers on the street are used. The station construction at each end of the bridge, requiring relatively little excavation, afforded places to concrete at the start of the job. Accordingly, concrete plants were set up early in the work at both ends.

Subways Enable Street Cars To Use Lower Deck

The Detroit-Superior viaduct, more than a dozen articles describing the design and construction of which have appeared in *Engineering News* and the *Engineering Record* since 1912, comprises a double-deck high-level steel arch of 591-ft. span across the Cuyahoga River, and concrete arch viaduct approaches. The upper deck, designed for vehicle traffic, is at the level of the streets at either end, while the lower deck, intended for street-car traffic, was to be reached by short depressed approaches.

In 1916, however, it was decided to modify this plan and construct a trolley station at either end of the bridge at the level of the lower deck. This means extending the four-track subway approach on the east end almost to West 6th St. on Superior Ave. and constructing a pair of two-track approaches on the west end, one extending three blocks west on Detroit Ave. and the other three blocks south on West 25th St. Although the approach for a short distance on the east end and for one or two blocks on each branch at the west end will be in subway, these structures are all being built in opencut, as it was possible to divert trolley lines and to take care of other traffic in the remaining undisturbed street width.

While the station at the west end is underground and required considerable excavation, that at the east end is largely open to the air, being above ground level on a side hill. It is carried on concrete footings extending to blue clay. The space under the floor is backfilled, the fill being retained by side walls and a cross-wall. The subway structures themselves are of reinforced concrete, the track being carried by a concrete floor bearing directly on the soil and independently of the columns and footings. The concrete roof is carried by the side walls and, in the four-track sections, by a row of reinforced-concrete columns between each pair of tracks. The open approaches consist of a

concrete retaining wall on each side and a continuation of the concrete floor of the subway.

Without much preliminary work it was possible to begin concreting on the stations at each end of the bridge almost from the start. Consequently, at each end a tower concrete plant was set up at the south side of the bridge near the center of each station. Each plant is arranged so that motor trucks can drive on top of the bins over the mixer and dump directly into them. The towers are tall enough to cover the area of the stations by direct spouting. For concreting the subway approaches, industrial track and side-gate cars, or cars carrying buckets to be handled by the cranes, will be used, supplemented by a short tower near the middle of the cut on Superior Avenue.

On the east end, derricks were set up to excavate for the piers and retaining walls, the material being dumped in a hopper and taken away by motor trucks. As soon as the footings and walls were concreted, the lower deck was finished before erecting the forms for the station walls and columns and the upper deck. The same procedure was followed at the west end, the floor of the lower deck being laid directly on the ground, and the earth excavated in the side of the hill to make room for the station being handled by a locomotive crane and also dumped into a hopper for disposal by motor truck. At this point a deep trench was constructed for the relocation of a sewer. The small amount of backfill required at the stations will come from the approach cuts later.

Wide Streets Make Decking Unnecessary

In constructing the approach cuts and subway sections in West 25th St. and Detroit and Superior Aves., the width of the streets and the possibility of diverting street-car traffic at the west end made it unnecessary to deck the streets. The car lines at the west end were detoured and the tracks entirely removed from the streets, the width remaining outside the lines of the subway excavation being sufficient for the vehicle traffic originating within the blocks affected. On the east side, the street-car tracks on Superior Ave. were shifted over to the north curb. The width of the street was sufficient to leave both sidewalks unobstructed, while the long block between West 6th and West 9th Sts. is open to one-way vehicle traffic on the south side of the street. A bridge crossing is maintained, however, from Columbus Road and West 9th St. to the south side of Superior Avenue.

The subway excavation, which is in sand at both ends, reaches groundwater at the deepest points, and it

STATION AT WEST END OF BRIDGE

MOTOR TRUCKS ON BROAD TIMBER RUNWAYS TOOK SAND AWAY AS FAST AS STEAM SHOVEL COULD DIG IT

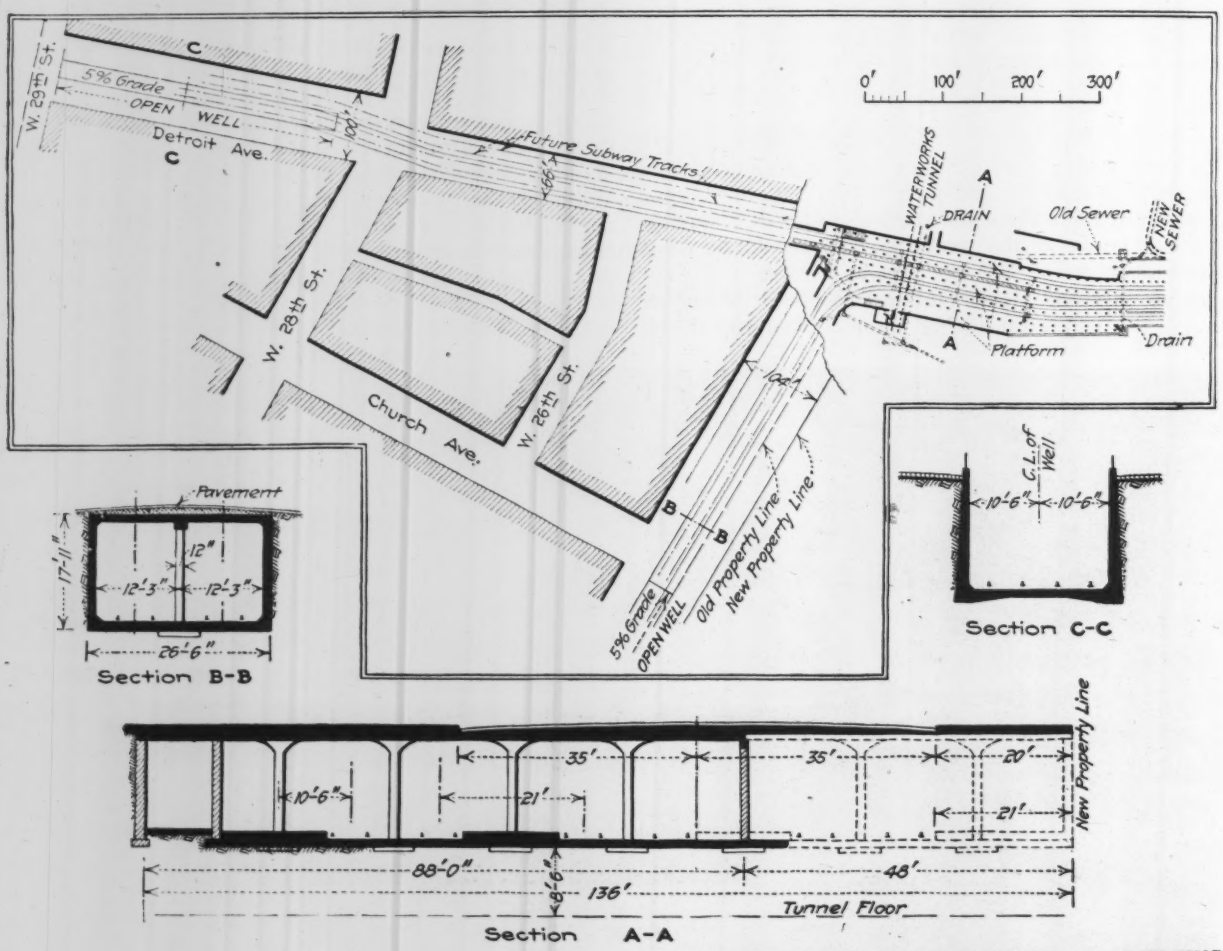
was necessary to sheet the sides of the cut. The best delivery on steel sheet piling that was promised was four months, whereas the entire contract was to be completed in less than a year. Wood sheeting was therefore decided on, and on account of the width of the cuts, heavy sheeting was necessary to avoid excessive bracing. Instead of using tongue-and-groove timber piling, however, the contractor has done the same work successfully and at much less cost by driving round piles on 2-ft. centers and placing behind the piles lagging of short scraps of 2-in. plank. About 3100 round piles were required in all, and about 100 M of plank. This method of sheeting was especially economical for the contractor, as nearly enough scrap from lumber for the entire work was left over from the Brooklyn-Brighton viaduct and other contracts recently completed in Cleveland by the same firm.

The use of the round piles, which could be quickly driven without jetting to a considerable depth below the bottom of the cut, also reduced the bracing required. Up to 12 ft. in depth, the piles act as a cantilever retaining wall without any bracing, each pile being driven as far below subgrade as the distance from subgrade to the surface. When the depth of the cut exceeds 12 ft., pile struts on 12-ft. centers are placed across the cut at the level of the top wale.

In estimating the pressure on this sheeting, it was assumed that the dry sand outside would take a slope of 33 horizontal to 41 vertical. Under this assumption it was found that only in a few places would a set of struts below the level of the ground surface be required. These were put in one-third of the distance from subgrade to the surface. They can be taken out as soon as the floor is concreted.

The round piling used as sheeting will be cut off 2½ ft. below the street surface and left in the ground. The piles were set 1 ft. outside the lines of the permanent structure. In addition to saving on the excavation, this type of sheeting will also prove an advantage in placing a large part of the concrete yardage. The industrial tracks for the side-gate concrete cars will be laid on stringers on top of the cross-struts, and the tracks can be shifted as required, so that most of the concrete except parts of the roof can be placed from the cars by gravity.

In making the four-track approach cut on Superior Ave., a ¾-yd. Marion-Osgood revolving shovel started in near West 6th St., working downgrade. The sheet piling had previously been driven, so that the shovel was able to excavate the cut down to grade for the full width. The shovel loaded 5-ton White motor trucks. From 3 to 12 trucks were employed daily on this cut,



WIDE STREETS, WITH POSSIBILITY OF DIVERTING THREE SUBWAY

depending on the conditions under which the steam shovel was working. On one occasion, 1000 yd. of sand were taken out in a 16-hour run with this equipment.

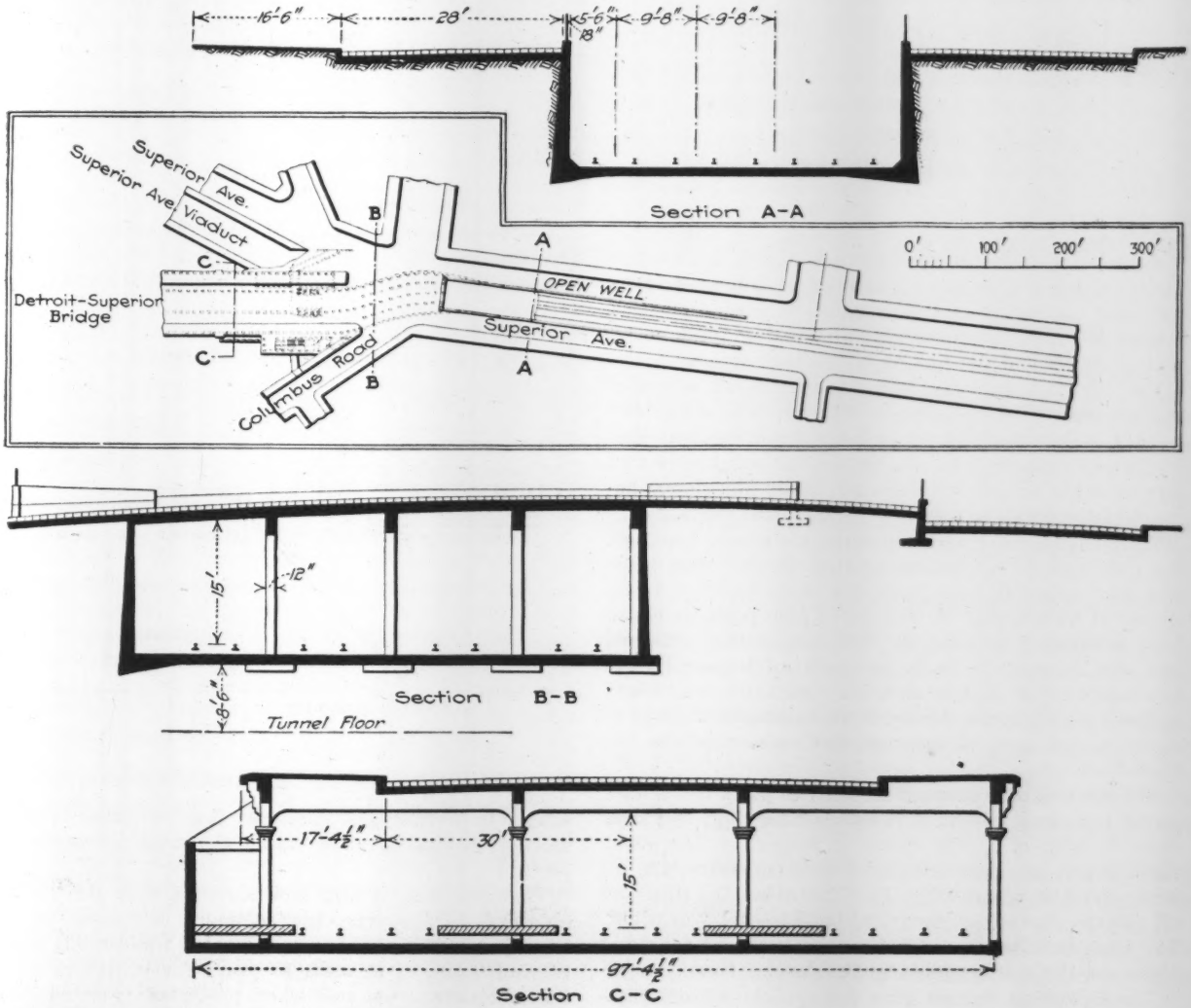
Trucks Run on Timber Track

The trucks at first came south on West 9th St., ran through the cut along the north side, passed the steam shovel and came out at the east end. This made it necessary to leave a bank with a sharp downgrade against the piling on the north side of the cut. As soon as the shovel had progressed to West 9th St., however, a passage was cut through the side of the hill into Columbus Road, which is on a steep descending grade at this point. Thereafter, the motor trucks came into the cut from the south through Columbus Road, traveling east and making their exit at West 6th St., as before.

The heavy trucks were operated on the floor of the sand cut with the greatest ease by laying for them sectional track made from old bridge stringers. Each section was made of two 8 x 16-in. stringers, 16 ft. long, laid flat side by side and bolted together. Two lines of such track were laid parallel, affording a runway for the wheels on each side nearly 3 ft. wide. The track was extended as excavation progressed by adding new sections, and no shifting was required until the change was made from bringing the trucks down West 9th St. to operating them through Columbus Road. All the dirt trucks used on the work have been supplied and operated by the Blake Motor Trucking Co. With this arrangement it is possible for the general foreman to estimate the yardage he will be able to dig the next day and order just enough trucks to handle it.

Crane and Traveler Excavate West Approaches

On the west approaches the steam-shovel and motor-truck combination was barred by several considerations. In the first place, there was no convenient side-hill street corresponding to Columbus Road which could be cut through at the proper moment into the deep end of the excavation. In the next place, the lowest part of the excavation was considerably deeper than on the east end, and less than half the yardage could have been handled by running the trucks down a steep grade and



TRAFFIC, MADE LOW-COST OPENCUT METHOD FOR APPROACHES POSSIBLE

out at the shallow end of the cut. When it came to a question of running in and turning around, the much narrower width of the 36-ft. cut for two tracks made such operation out of the question. A shovel that could work in this cut would only be able to load trucks on the street surface when the depth of cut was 6 ft. or less. Furthermore, the scheme could not have been used at all for a considerable yardage of excavation on the site of the station at the west end. For this work a locomotive crane, a traveler derrick and dirt hoppers were required anyway. As this plant was on hand and was also better adapted to the problem than the excavation plant used at the other end, it was planned to have the locomotive crane take out one cut and the traveler derrick the other to full depth, beginning at the deep end near the station. The crane and derrick were helped, however, by using the steam shovel in the shallow ends of the open wells on Detroit Ave. and 25th St. after it had completed the excavation at the east end.

About 66,000 yd. of sand were removed at the west end of the bridge, while 29,000 yd. were removed at the east end. Almost all of this was disposed of by the trucking contractor at various points around the city, very little backfill being required. The total yardage of concrete required on the east approach is 6000, while 11,000 yd. will be placed in the west approaches.

The two ends of the work are more than a mile apart by the nearest route, and each is in charge of a general foreman operating independently of the man at the other end. A separate job office is also maintained at each end of the bridge. The entire work is under the personal direction of C. S. Smith, in charge of the Cleveland office of the contractor, the Bates & Rogers Construction Co., while Charles Steen at the west end and J. H. Doll at the east end are general foremen. The work is under the jurisdiction of W. A. Zesiger, bridge engineer, and W. A. Stinchcomb, county engineer of Cuyahoga County, and is being carried on under the immediate supervision of K. D. Cowen.

Open-Tank Treatment of Timber Urged for Small Railroads

Used by Virginia Railway and Power Company for Poles and Other Pine Timber—Cost $15.49 per Thousand Feet

BY CLAUDE GILBERT BENHAM

Assistant Chief Engineer Railways, Virginia Railway and Power Company, Norfolk, Va.

OPEN-TANK treatment of timber, the writer believes, is desirable for interurban and the smaller steam railroads that have a number of timber bridges and other timber structures to maintain. Such a plant as is here described is convenient for treating fence posts, paving blocks and the like on very short notice.

The Virginia Railway and Power Co. has operated an open-tank treating plant at Norfolk, Va., since May 1, 1914, using dead oil of coal tar from its own gas-works as a preservative. Water-gas tar was tried as an experiment for a few months and finally abandoned because of the small saving and its doubtful value.

Yellow pine, mostly of merchantable grade, has been the only species of timber treated in the open tank, and has varied in size from 2 x 4-in. to 14 x 14-in. timber of all lengths. A number of pine poles have also been satisfactorily treated. The penetration obtained has been from 12 to 20 lb. per cu.ft. of timber. Well-seasoned timber is desirable for open-tank treatment; in the case of green timber it is necessary to keep it in the tanks until it becomes well seasoned from the heated oil.

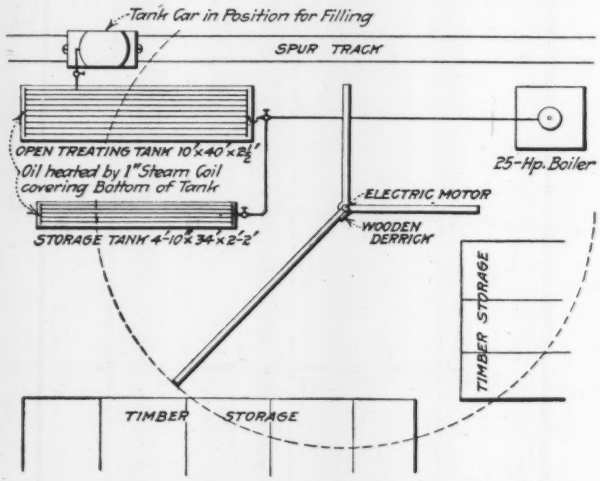
The method of treatment is, first, to place the timber in the tank and weight it to prevent floating, and then cover it with oil. The steam is turned on for about eight hours, at approximately 100 lb. pressure, the oil being kept at about 200° F. The steam is then cut off and the oil and timber are allowed to cool over night. The next day the timber is removed from the tank and placed on the storage piles by the derrick boom.

The following figures give the actual cost of treating at this plant for one month. One foreman (who also operates the electric derrick) at $3, one fireman at $1.50 and four laborers at $1.50 per day are required, working under the bridge supervisor. A total of 39,098 ft. b.m. was treated. The costs were as follows:

Item	Total	Cost per M Ft. B.M.
Dead oil of coal tar, 7,375 gal. at 6½c.	$479.38	$12.23
Coal, 6,800 lb. at $3 per ton	9.10	.23
Labor, including foreman	83.50	2.14
Maintenance of plant	20.00	.51
Interest on $3,000 investment	15.00	.38
Total expense for one month	$605.98	$15.49

Average penetration, 19.6 lb. per cu.ft. of timber

The drawing shows the layout of the treating plant. The smaller tank is used for treating only in emergencies. The dead oil of coal tar is brought from the gas-works in a 2200-gal. tank-car that is fitted with a section of pipe to allow filling the treating tanks directly.



TREATING-TANKS FILLED DIRECTLY FROM CAR

This company is very well satisfied with the results obtained. Of course, the company is unable to determine the life of this newly treated timber, but is expecting a life of at least 15 years for bridge timbers, and the same from ties when protected from mechanical wear by tie-plates.

Government Building Operations Need Strong Central Control

An Engineer in Washington Analyzes the Situation and Outlines an Urgent Need of Our National Military Building Work

By Construction Observer

A FEW DAYS AGO Congressman Fitzgerald told the House of Representatives that it is high time for the financial affairs of the nation to be managed on some kind of budget system. The occasion for the remark was the necessity of voting over $600,000,000 for aviation purposes, an appropriation not recommended by the House Committee on appropriations, in the usual way, but fathered by the Committee on Military Affairs in order to keep its details secret. But it happens that even without referring to those government operations where secrecy is necessary for military reasons, the need for something like a coördinated program is very clearly apparent here in Washington, especially when one considers the enormous building operations the government is now carrying on without any central management whatever.

Many Government Bureaus Build Independently

Buildings are planned or under construction by the Corps of Engineers, Quartermaster Corps, Ordnance Department, Medical Department and Signal Corps of the army, the Bureau of Yards and Docks and Marine Corps of the navy, and the Treasury Department. An energetic attempt by a competent investigator with access to all these bureaus failed to give any definite information concerning the total amount of money involved in these building operations. The fact that under one appropriation bill alone the Quartermaster Corps is spending nearly $80,000,000 in less than six months gives an inkling of the conditions.

The different bureaus conduct their operations quite independently. They are buying materials from the same people, drawing skilled and unskilled labor from the same districts, and hounding the same railway companies for cars and prompt transportation. At the same time a host of private companies is struggling, against the serious competition of these government bureaus, to erect buildings in which to carry out government contracts.

Two or more bureaus may be building structures for the same purpose in the same district, yet the absence of any standardization of government work results in different structures.

There Is No Central Control

At the present time there is an indefinite and quite limited supervision over this building program through the Advisory Commission of the Council of National Defense. The Council was created by the military appropriation bill for last year, to advise the President and the Cabinet regarding the mobilization of the nation's resources for war, and the Advisory Commission was created to assist the Council. It has many sub-committees which have been gathering information regarding labor conditions, the available raw materials for manufacturing needs, and the productive capacity of each industry.

When any government bureau needs materials and labor it applies, if it sees fit, to one of these committees for advice. Consequently each of these committees may have some knowledge of conditions in its special field, and the reports of these small committees to the larger committees give the latter *some* knowledge of conditions in various allied fields. Material help has been rendered the government bureaus in this way, and without such help the work of the government would now be hopelessly tangled up.

Government Work Needs Same Aids As Private Work

The government is not working for profit, the usual tests for determining efficiency of management cannot be applied to these enterprises, and if anything goes wrong the pocketbook of the taxpayer can be drained again. That is no reason, however, for not placing the work on a business-like basis, or for neglecting to provide coöperative control.

Central control is the element that enables a great contracting organization, doing work simultaneously in many parts of the country, to afford those little daily helps to each contract which cannot be obtained locally, must be given immediately and prevent serious delays and troubles. Anybody who knows how widely spread private building is carried on and sees the lack of coordination in the government's enormous undertakings cannot fail to realize the need of a centralized bureau, not to take over the work of any existing organization but to help each of them through its knowledge of the conditions in all.

An Object-Lesson Case

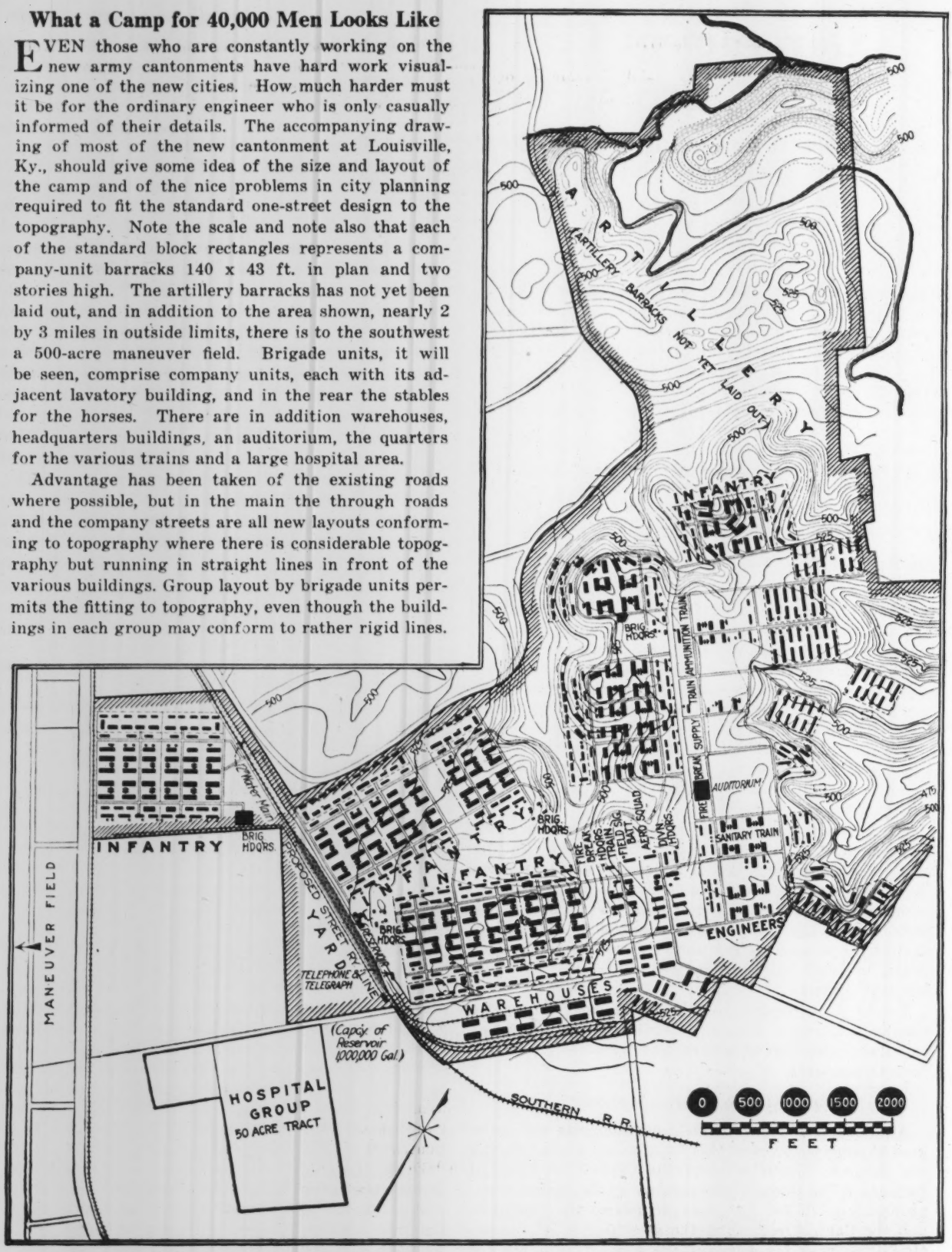
The conditions in the vicinity of Norfolk may be taken as an illustration of what will happen unless the government building work is systematized. Thousands of additional workmen are needed there, and hundreds of workmen now there are without proper lodgings and food. The only way to bring any order out of the chaos is to have all the work carried on according to a program by which the most pressing needs will be met first.

Under the guidance of such a program, handled by a capable organization, the men to carry on the work will not be assembled until they can be housed and fed, and the rivalry between different undertakings will be stopped, thus preventing needless rise in wages which demoralizes the labor situation in the entire section.

What a Camp for 40,000 Men Looks Like

EVEN those who are constantly working on the new army cantonments have hard work visualizing one of the new cities. How much harder must it be for the ordinary engineer who is only casually informed of their details. The accompanying drawing of most of the new cantonment at Louisville, Ky., should give some idea of the size and layout of the camp and of the nice problems in city planning required to fit the standard one-street design to the topography. Note the scale and note also that each of the standard block rectangles represents a company-unit barracks 140 x 43 ft. in plan and two stories high. The artillery barracks has not yet been laid out, and in addition to the area shown, nearly 2 by 3 miles in outside limits, there is to the southwest a 500-acre maneuver field. Brigade units, it will be seen, comprise company units, each with its adjacent lavatory building, and in the rear the stables for the horses. There are in addition warehouses, headquarters buildings, an auditorium, the quarters for the various trains and a large hospital area.

Advantage has been taken of the existing roads where possible, but in the main the through roads and the company streets are all new layouts conforming to topography where there is considerable topography but running in straight lines in front of the various buildings. Group layout by brigade units permits the fitting to topography, even though the buildings in each group may conform to rather rigid lines.



THIS IS THE LAYOUT OF THE ARMY CANTONMENT AT LOUISVILLE, KY., AS IT WAS MADE BY THE LOCAL ENGINEER FROM STANDARD PLANS FURNISHED BY THE WAR DEPARTMENT AT WASHINGTON

Work for the Year Outlined for A. R. E. A. Committees

Two New Committees Created To Study Economics of Railway Operation and Economics of Railway Labor

TWO new committees, on economics of railway operation and economics of railway labor respectively, have been created by the American Railway Engineering Association. They are numbered 21 and 22, the Special Committee on Uniform General Contract Forms being made Standing Committee 20. The assignments to the new committees, as announced in Bulletin 196 of the association, are of a general nature, to line up the scope of the committees. Following are new assignments to the other twenty-two committees. The committees are also instructed to continue most of the numerous investigations assigned a year ago.

Roadway—Subsidence under the shrinkage of embankments.

Draining roadway through stations and yards.

Ballast—Physical tests of ballast, and chemical also if necessary.

Ties—Methods for controlling tie renewals.

Proper dimensions for cross-ties.

Investigation as to whether statistical forms are in general use.

Track—Effect of fast trains on cost of maintenance-of-way and equipment.

Masonry—Designs and specifications for concrete culvert pipe.

Signs, Fences and Crossings—Further study of concrete fence posts, investigation of all styles of manufactured parts, and special study of end or strain posts.

Revised analysis of comparative annual cost of fences with wood, metal and concrete posts.

Signals and Interlocking—Requisites of signal locations for interlocking and block signals.

Records and Accounts—Cost-keeping methods and statistical records.

Systematic arrangement for final plans in connection with estimates.

Allocation of maintenance-of-way expense to passenger and freight service.

Various specified report forms.

Water Service—Organization for railway water-service department.

Definitions of terms in railway water service.

Suitable types of water meters, and methods followed in testing and reading same.

Wood Preservation—Water-gas tar as a preservative.

Electricity—Desirable changes in national electrical safety code issued by Bureau of Standards.

Conservation of Natural Resources—Statistics on extent of use of treated timber and of permanent materials to replace untreated timber and bare steel.

Conservation of human life and energy.

Grading of Lumber—Specifications for construction timbers and building lumber for use on railways, showing each kind and quality of lumber suitable for each class of work.

Specifications for timber to be treated with a preservative.

No new assignments were made to any of the other committees.

F. W. Green and V. K. Hendricks are respectively chairman and vice chairman of the new Committee on Economics of Railway Operation, which has 27 members. E. R. Lewis and C. H. Stein are respectively chairman and vice chairman of the new Committee on Economics of Railway Labor, which has 22 members. F. R. Layng succeeds L. A. Downs as chairman of the Committee on Ties and is succeeded as vice chairman by H. S. Wilgus. J. R. Leighty succeeds H. R. Safford as vice chairman of the Committee on Track. J. A. Peabody succeeds C. C. Anthony as chairman of the Committee on Signals and Interlocking, and is succeeded as vice chairman by W. J. Eck. Joseph Mullen succeeds C. Dougherty as chairman of the Committee on Rules and Organization. O. E. Selby succeeds A. J. Himes as chairman of the Committee on Iron and Steel Structures, and is succeeded as vice chairman by Prof. F. E. Turneaure. R. N. Begien is again made chairman of the Committee on Economics of Railway Location, succeeding John G. Sullivan. C. M. Taylor succeeds E. H. Bowser as vice chairman of the Committee on Wood Preservation. E. B. Katte and A. G. Shaver are made respectively chairman and vice chairman of the Committee on Electricity, replacing G. W. Kittredge and D. J. Brumley. The membership of most of the committees is increased.

Sealing a 200-Acre Reservoir

To Stop Serious Leak from Cedar River Reservoir Bottom Clay and Gravel Are Being Sluiced in Above Dam

BY J. D. ROSS

Superintendent Lighting Department, Seattle, Wash.

WHAT is probably the largest task of reservoir-bottom sealing ever attempted has been undertaken by Seattle, Wash. The reservoir to be sealed has an area of about 200 acres. The dam across Cedar River which forms the reservoir is an excellent one and has cost about $1,800,000. Its foundations are on bedrock. However, for a distance of over a mile, the north bank and the bed of Cedar River show a considerable leak, which appears through 4000 ft. of gravel in about sixteen days.

CLAY PLENTIFUL

Drilling in the neighborhood of Cedar Lake has shown at least 8,000,000 cu.ft. of excellent clay, and drilling in the lake itself has shown that the greater part of the material on which it rests is blue clay, although the north bank of the lake has naturally silted against material similar to that which is now to be treated. The waters of Cedar River running into the lake are absolutely clear almost the entire year, and at such times as they are not clear the silt all settles in the lake so that the new basin cannot seal of itself.

A pump with a capacity of 4000 gal. per min. is being installed, and this is to be connected to about one mile of 16-in. pipe, which will carry the water to an elevation of approximately 350 ft. for the sluicing out of the clay bed which has recently been discovered. The ma-

terial will be carried over grizzlies, the bars of which will be set close, as only the fine material is required. This will be carried back to the north bank of the river and along the distance to be treated. The bank is steep, and a considerable amount of material has to be sluiced into the river bottom in order to get the proper grade for silt to remain on the surface. The water, with clay in suspension, under the 350-ft. head above mentioned, will be used in sluicing the gravel from the bank and in this way will be incorporated with the gravel at the bank, the intention being to use about one part of clay to three or four parts of gravel. The first thousand feet next to the new dam will be treated first.

The present rate of seepage of the water is being carefully measured and a recording gage is being installed which will give the seepage from time to time as the sealing proceeds.

As this work is primarily for the city light and power plant, and since later on the storage will also be of use to the water department, the work is being done by J. D. Ross, superintendent of the lighting department, in conjunction with L. B. Youngs, superintendent of the water department.

Vast Amount of Construction Material Required for Army Camps

Figures just issued by the War Department will go far to give an idea of the magnitude of building activity which will be necessary for the construction of the 16 Army cantonments. These figures deal with the estimated amounts of material required, and cover such important items as lumber, electrical equipment, roofing and concreting materials.

In the Southern States there will be about 5,600,000 board feet of boards, 7,800,000 board feet of dimension stuff, 177,000 ft. of 4 x 4-in. timbers, 2,800,000 ft. of flooring, 1,200,000 ft. of siding, and 1,400,000 ft. of matched boards. In the northern cantonments the amount of lumber will be increased about 216,000 board feet.

Nails and Sheathing Required

To construct one of these cantonments in the South it will be necessary to use over 2500 kegs of nails, and in the northern cantonments about 2650 kegs. The buildings in a southern cantonment will require 4800 rolls of sheathing paper, 6300 squares of one-ply roofing, 21,900 squares of two-ply roofing, and about 2000 rolls of tarred felt. In the northern cantonments the amount of one-ply roofing will be reduced to about 800 squares, while the amount of tarred felt will be increased to 3200 rolls, on account of the more rigorous climatic conditions.

The concrete work in a cantonment is estimated to require 4700 bbl. of portland cement, 1400 cu.yd. of sand, and 2500 cu.yd. of broken stone or screened gravel.

The amount of electrical equipment will vary with the shape of the cantonment. The estimate for the total requirements for the 16 military cities amounts to 20,800,000 ft. of insulated wire, 260,000 ft. of lamp cord, and other items on a similar scale.

Ohio State Concrete Roads Have New Specifications

Proportioning Permits Use of Variable Amount of Cement—Mix To Be in Machine at Least One Minute

NEW specifications for roads issued by the Highway Department in the State of Ohio under the direction of Clinton Cowen, State Highway Commissioner, have some interesting provisions regarding the specifications for concrete pavement.

In proportioning, for instance, the specification reads as follows: "The ingredients of concrete shall be mixed in the proportion of one sack of cement to 1½ cu.ft. of fine aggregate and not more than 3 cu.ft. of coarse aggregate. The mortar shall always be more than enough to fill the voids in the coarse aggregate. If necessary to secure this result, the proportion of coarse aggregate shall be reduced. In general this will require from seven to eight sacks of cement per cubic yard of concrete, depending upon the class of aggregate used and the percentage of its voids." There is no method given, however, of determining when the voids are filled.

Consistency Requirements

In consistency, the new specification is as follows: "The materials for the pavement shall be mixed with only sufficient water to produce a concrete which will settle very slowly when deposited in a pile and which will hold its shape when struck with a templet. The consistency shall not be such as to cause a separation of the mortar from the coarse aggregate when handling. After the concrete has been lightly tamped, there shall be no free water in evidence. Individual particles of the coarse aggregate when so isolated shall show a coating of mortar containing its proportionate amount of sand." In this specification also there is no quantitative measure for any of the results demanded.

For machine mixing, it is required that the mixing shall continue at least 1 min. until the drum has made not less than twelve revolutions at a speed of between 12 and 18 r.p.m. before any part of the batch is discharged.

Definite Information Given as to Finishing the Concrete

For the finishing of the concrete, very definite information has been given. As the finished surface must conform within ¼ in. to the templet or straight-edge laid parallel to the center line, the procedure is given. By a combined horizontal and crosswise motion the concrete is struck off ½ in. high, then tamped and finally recut to the exact finished pavement. When 3 ft. from the joint the templets are lifted to it and then leveled and compacted away from the joint. An 8-ft. wooden float, not less than 6 in. wide, is to be operated from two bridges, and this float is given in a detail drawing in the specification. The axis of the float is to be parallel to the center line of the pavement. For final finishing a float 20 in. long and 6 in. wide is used, or a belt may be employed. At the joints a split float is specified. All of these floats are to be provided by the contractor at his own expense.

The American Surveyor in the Philippines

Hardships and Dangers Are Many and Varied—Much Time Lost Settling Disputes—Health Important

By J. W. EVANS

Surveyor in the Philippines 1913-1916; now Instructor in Civil Engineering, Oklahoma Agricultural and Mechanical College

THE lack of clear land titles has been a serious hindrance to the economic progress of the Philippines, since banks cannot safely lend to landholders whose rights are not clear. This need was early recognized by our Government, and it was directed that surveys be made or approved by the Bureau of Lands for those individuals who wished to obtain a title. As a result of this provision many isolated tracts were surveyed, and after plans were prepared and all claims settled the owners were granted Torrens titles. The expensive system of surveying isolated tracts has been practically abandoned since 1913, and now nearly all effort is directed to the surveying at one time of all lands within a municipality or county.

Filipinos Being Promoted

This work has been carried on by Americans, most of whom were chosen by competitive examination in the United States. The policy of giving the Filipinos a continually greater part in the management of their own government has been responsible for the recent withdrawal of a large number of Americans from the Philippine service. Positions thus made vacant in all branches of the government are being taken by natives who are being rapidly promoted from subordinate places. A reduction in efficiency, at least temporary in nature, is to be expected as a result of these changes, since many of the new men have inadequate training; but it is hoped that the Filipinos will measure up in ability and ideals to the opportunity before them. The number of American employees in the Bureau of Lands has been reduced from about a hundred men, most of whom were engaged in fieldwork, to a very few who are occupying supervisory, but not the highest, positions. The work of the American surveyor in the Philippines is practically finished.

It has been the practice to station three or four surveyors in the largest town of a municipality for which a survey has been authorized, and these men operate from this headquarters in executing the necessary primary, secondary and tertiary traverses. The primary traverse consists of the accurate measurement of angles and distances between a series of monuments placed in a line which runs around and near the boundary of the municipality. The monuments, or stations, are placed less than one kilometer apart and it is usually possible to measure all distances, so that little triangulation is necessary. Great care is exercised in the field and office work in connection with traverse, and the allowable error of closure is $1\sqrt{L}/224$, where L is the length of the traverse. The computations show the rectangular coordinates of each primary monument. Directions are obtained by solar or stellar observations in each municipality, and it is usually possible to compare the results so obtained with those given for near-by Coast and Geodetic Survey stations.

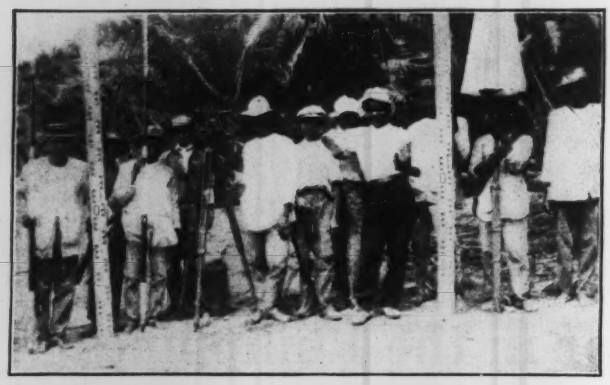
Secondary Traverses and Sketches

Secondary traverses are run across the project connecting different points of the primary traverse, and the secondary stations are so placed that they will be most convenient as starting and closing points for the tertiary traverses.

After the completion of primary and secondary measurements, preliminary sketches, showing all property lines, are made by native assistants. These sketches are later taken into the field by the surveyor to facilitate the location of boundary lines. It is during the tertiary survey that the measurements are made from which areas are determined and plans prepared. The lot corners are located by side shots from tertiary stations. All distances are measured by tape and are

checked by stadia, while all azimuth readings are recorded to the nearest minute and are checked with the magnetic needle.

The surveyor's party consists of ten to fifteen native laborers whose wages range from 25c. to $1.50 per day.



THE SURVEYOR'S PARTY CONSISTS OF FROM 10 TO 15 NATIVES WHOSE PAY RANGES FROM 25 CENTS TO $1.50 PER DAY

One of these men usually acts as interpreter and foreman, while another is surveyor's cook.

There is no attempt made to subdivide the land into rectangular townships or sections. The surveyor's business is to make his measurements as directed by the property owners. The result is that parcels are irregular in shape, making their survey relatively expensive, since a 40-acre tract is more likely to have forty corners than four. It is not uncommon to find parcels having 200 corners. The lots range in size from a few square yards to several thousand acres.

The surveyor loses much of his time in attempting to settle disputes about the location of boundary lines. He has no authority as a judge, but often brings the disputants to an amicable settlement, making litigation unnecessary. These disagreements are at times the result of encroachments which a wealthy or powerful individual has made on the rights of a poor and ignorant

WHERE THE ROAD IS A TRAIL

neighbor. Another class of disputes arises from the rival claims to inherited property, and these are most difficult to adjust because of the intricacy and uncertainty and extent of family ties. An occasional result, for example, is that from an ancestral estate of a city lot, a dozen square yards, on which are growing two coconut trees, are allotted to a grandchild whose origin and rights may not be legitimate but are respected.

Another source of delay is the inaccuracy of the plans and titles which have in some instances been issued by the Spanish Government. It is seldom that the existing property lines agree with those described in such plans, and not infrequently the distances shown are found to be 100, 200 or 300 meters in error, and the directions are reversed. The surveyor occasionally finds on inquiry that his predecessor obtained his figures by estimation and guess while in the landholder's house.

Since there are no fences to guide the surveyor it is necessary that all interested owners be present at the time of survey and that they point out the exact location of boundaries, so that monuments may be placed at those corners where permanent marks do not exist.

The conditions under which the surveyor lives are such that his life is made interesting in spite of many discomforts. The food supply consists of imported canned goods, supplemented by fruits, vegetables and chickens of native growth. The cook buys the latter in the local market, and he devotes more thought to in-

THE COOK IS AN IMPORTANT MEMBER OF THE SURVEY PARTY

creasing his income by manipulating his expense account than to the preparation of clean, well-cooked food. Cleanliness is not a natural characteristic with him, and he acquires it with difficulty and never thoroughly. As a protection against disease it is the custom to boil all drinking water, and the surveyor does well to inspect this operation occasionally to see that the roaches are removed from the kettle before boiling begins.

During much of the time the surveyor is required to lodge at the home of some farmer or villager, since hotels and restaurants are seldom found. He meets with hospitality that is limited only by the means at the farmer's disposal. At times this hospitality consists of the excellent food and cordial friendliness offered by a wealthy sugar planter, or in the more sparsely settled country it may be so limited that the surveyor and his party must occupy the same one-room house with the farmer and his family. Except in a few homes the beds are either entirely lacking or are too short for all of an American to rest upon, so the surveyor includes in his equipment a folding cot, blanket and mosquito net.

The surveyor leads a strenuous life, and needs to care scrupulously for his personal well-being. He is exposed

to the penetrating rays of the tropical sun through the long, dry season, and to the soaking rains during the remainder of the year. He must at times work all day in the flooded rice paddies. He must flounder through the mud and water of the vile-smelling salt-water marshes, where he may wade instead of swim across the innumerable streams if the tide happens to be out. He must make his way through thickets where grass grows 15 ft. high and the blades are razor-edged.

ON THIS CONVEYANCE CORNER MONUMENTS ARE TRANSPORTED

In the forest he must learn by painful experience not to touch the leaves that burn like fire. He must learn to keep himself and his clothing intact while extricating himself from the clutches of vines whose hooks hold him with superhuman skill while the thorns stab him mercilessly. He must travel over slippery trails along steep precipices, even when an attacking swarm of bees impels him to sacrifice safety for speed. He must live alone for weeks at a time in lonely places where amusements are few, where the restraint of American ideals and society is lacking, where it is easier to degenerate than to live decently.

There are compensations for the hardships and dangers. A climb to the top of a mountain in usually repaid with a view that is as beautiful and restful as any that nature affords, combining into one panorama a wonderful expanse of forest, field, sea, sky and distant islands. In the forests there are birds and orchids of unlimited variety, and high-class entertainment is furnished by families of acrobatic monkeys in their natural environment. Association with the natives is interesting and informing, and while it is not especially elevating, it need not be otherwise. Usually the American surveyor has learned to endure and ignore the hardships and has enjoyed his foreign service, in spite of the fact that letters from home are five weeks' old and that he is utterly unable to speed up the East to the customary American pace.

A few surveyors have been maimed or murdered by revengeful or fanatical natives, and some have been physically unable to stand the strain of the work and isolation. Others have suffered because moral laxity in the Philippines is easy and the retribution for it is swift. Nearly all, after three or four years of service, have returned to the United States, wiser than when they left, but no better and little wealthier, and have found that their foreign experience has been of little value to them in furthering their interests here.

Atlanta Fire Had Lessons for City Officials and Engineers

Minor Fire Rapidly Spread by Brands Igniting Shingle Roofs—Dynamiting of Little Value—High-Pressure Water Desirable

THE Atlanta, Ga., conflagration of May 21, 1917, has been investigated by the National Board of Fire Underwriters and reported on in an elaborate document recently issued. There are many points of information well worth the study of all engineers and officials connected with city building regulations or construction.

The fire devastated a total area of about 300 acres; the number of buildings involved was 1938, of which 47 were brick and 1891 frame. Classified by occupancy, there were 1537 dwellings and apartments, 42 mercantile, 351 garages and outhouses, and 8 miscellaneous occupancies, including churches, schools, special houses and warehouses. Of the total number of buildings, 1682 or about 80% had shingle roofs.

It is estimated that the total property loss was about $5,500,000, of which $3,500,000 was covered by insurance. Extensive damage was done to the trolley wires, feeders and poles of the street railway system, amounting to approximately $125,000, and probably a like loss was suffered by the telephone company. The direct expense of the city was heavy; approximately $20,000 worth of hose was destroyed, and the cost of bringing outside aid was considerable. About 10,000 people were made homeless, and a large number of these being of poorer classes became immediately dependent upon the city, which involved another expense. These figures show without further comment what such a fire means to any community. The bettering of conditions which may prevent such a conflagration in many ways devolves upon the engineering fraternity.

Fire Spread by Wooden Shingle Roofs

The fire started in a small frame building at a time when three other fires were raging in different parts of the city. Partly due to this fact the fire fighting was somewhat delayed. By the time organized effort had been started, the embers from the original fire alighting on near-by dry roofs quickly ignited the wooden shingles, with the result that a series of conflagrations soon had started up, extending over a large area from a quarter to a half mile ahead of the fire department. The report has a remarkable series of photographs showing the development of five separate fires, all started from flying brands.

The conclusions of the committee on Fire Prevention of the National Board of Fire Underwriters may be briefly summarized as follows: This conflagration, together with two of the other fires occurring at the same time, emphasizes the ease with which spreading fires may develop in cities where wooden shingle roofs predominate, even when the fire department is mainly well equipped and manned. It illustrates the startling suddenness with which a fire may grow into a conflagration under favorable conditions. For a period of eight hours the remaining part of the city, including the business district, was practically without protection. A shift

of the wind during the progress of the fire would have resulted in a corresponding change in the path of devastation and might have involved the business district, where the high values of the city exist, for it would have been impossible to stop the spread through the shingle roof area which even now extends to the edge of that district. The fire department apparently worked well and efficiently, but all of its efforts were of little avail because of the prevalence of shingle roofs, which permitted flying brands to start local fires blocks beyond the actual fire and far ahead of the location of the fire apparatus.

Motor Fire Apparatus and High Pressure Needed

Motor apparatus instead of horse-drawn equipment is strongly recommended because of its superiority in covering long-distance runs. The value of high pressures on the distribution system is shown by the extensive use of hose lines direct from hydrants. Places where these were reported as too weak to be effective were mainly on high ground where the gridiron was weak. The need of a complete secondary feeder system is evident in this connection, and the more general use of 8-in. mains for minor distributors in sections along the edge of the system would have improved the supply.

Although no shortage of pump or of boiler capacity was experienced, all equipment at the pumping station was in use. Had one of the units been out of service for repairs, or had it broken down during the fire, conditions might have been serious. The need of ample reserve in both pumps and boilers to provide for such contingencies is evident. Numerous hydrants in districts of this character and hydrants of good dimensions with steamer outlets and 6-in. connections to the mains are evidently needed to combat a spreading fire.

Improved streets are of material value in a conflagration of this kind, as in many sections the unimproved stretches make long detours necessary for the apparatus.

Structural Tests Were Missing

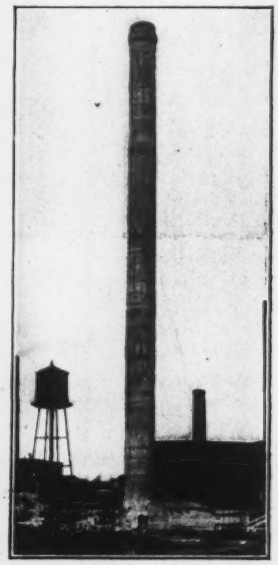
Sprinklered buildings did not have a very extensive test, as only one was directly exposed to the conflagration. This one, however, stood up very well as a fire stop, the flow forming a water curtain down one face. As no fireproof buildings or semifireproof buildings were in the path of the fire, no test of these was available.

The usual difficulties with different sizes of hose, couplings and thread were experienced in the use of equipment from neighboring cities.

Contrary to widely advertised information, the dynamiting of buildings to stop fire is not particularly commended by the National Board of Fire Underwriters. It says: "The value of dynamiting buildings to prevent spread of fire in this case is questionable. It is not apparent from the ruins that any good resulted from such work done on or near Ponce de Leon Ave. With the wide street intervening and the narrow face of the fire, the department, together with the military forces which were doing excellent work at this time, stopped the spread from direct exposure, and the wider spacing of the buildings and the newer roofs were very favorable to the work of preventing spread of flying embers and brands. The fire department is of the opinion that the dynamiting on Hunt St. was of some value, as it allowed buildings to be wet down with direct hose lines which otherwise would have been of insufficient reach."

Tapering Concrete Chimney Has Double Shell

Arrangement Improves Draft and Efficiency and Reduces Liability of Cracks—Height of Chimney 180 Feet



CONCRETE CHIMNEY 180 FEET HIGH BUILT WITH STEEL FORMS

A SPECIAL arrangement of the interior shell and the use of adjustable steel forms to give an exterior taper are the features of the reinforced-concrete chimney shown in the accompanying view. It is 180 ft. high above the ground (187 ft. above the footing), with an interior diameter of 7 ft. throughout. The outside diameter is 10 ft. 4 in. at the footing and 9 ft. at the top, with a taper of 0.056 in. per foot, commencing at the top of the breeching. The chimney is at the plant of the Rockford Paper Box Board Co. It was designed and built by Charles C. Stowell, civil engineer, of Rockford, Illinois. In the numerous chimneys that have been built by Mr. Stowell the inner shell has been carried nearly to the top, in order to protect the outer wall and to improve the draft efficiency. There are two reasons for this. In the first place, this arrangement maintains a uniform current in the gases throughout the height of the chimney. If the inner wall is carried only a little above the breeching or flue connection (30 ft. is allowed by the Chicago ordinance), counter-currents are formed which are known to materially affect the efficiency.

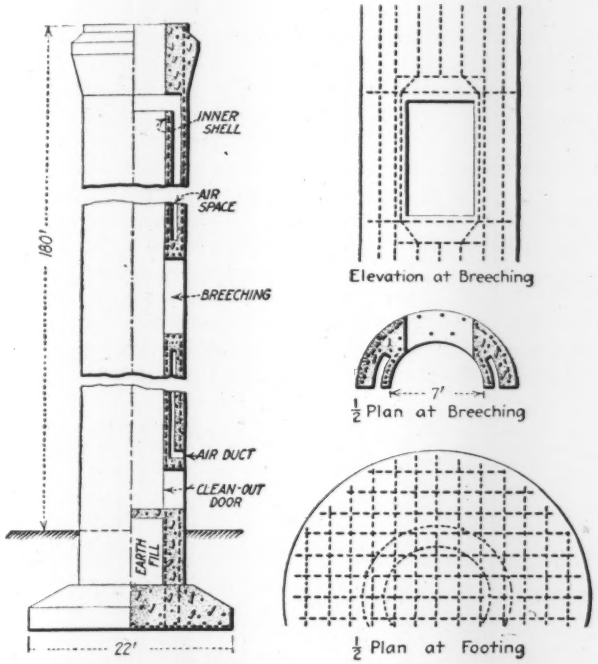
Cracks Occur at Top of Interior Wall

In the second place, the gases, when only slightly cooled, come in contact with a relatively thick portion of the outer wall, thus heating its inner surface while the exterior may be exposed to very cold weather. As concrete is a poor conductor of heat, this condition results in severe internal stresses, and Mr. Stowell states that his observations of many chimneys built in this way indicate that the most serious cracks occur about the level of the top of the short interior wall.

To create a draft in the air space, in order to protect the outer wall from high temperatures and to prevent the collection of soot, openings in the outer wall are made at the base of the air space. The inner wall is made as thin as practicable in order to minimize

unequal expansion and is 4 in. thick for its entire height.

The thickness of the outer wall of the chimney illustrated reduces from 12 in. at the bottom of the air space to 4 in. at the top of this space (beneath the cap). In Mr. Stowell's nontapering chimneys the variation in thickness is made by offsets on the inner side, but in this case the inner side is vertical and the reduction is made by the tapering of the outer side. This taper was given by the use of Reichert adjustable steel forms. These were in lifts 2 ft. high, and the diameter was reduced at each lift. These forms account for the vertical marks shown on the view of the chimney. The forms were found very flexible, and the same ones used for the stack were made to serve also for the enlarged head, or cap.



CONCRETE CHIMNEY WITH INNER SHELL EXTENDING FULL HEIGHT OF SHAFT

Inside Tower Carried Working Platform

The concrete is a 1:2:4 mix, made with gravel ¼ to 1 in. in size. It was hoisted in buckets in an inside tower, which carried the working platform. Work was begun Jan. 22 and finished May 4. It was stopped about one week during extremely low temperature. The concrete was heated in cold weather. The reinforcement consists of steel rods and hoops in each wall, the vertical rods being hooked to the rods in the base of the footing. This footing is 4 ft. thick and 22 ft. in diameter on the base. It is built directly upon a stiff clay formation, no piles or other special treatment being required.

In Mr. Stowell's opinion, concrete gives a smoother surface than brick and has less air leakage, owing to its greater density. Thus the draft is better, and for a given power load or efficiency a concrete chimney may be smaller than a brick chimney.

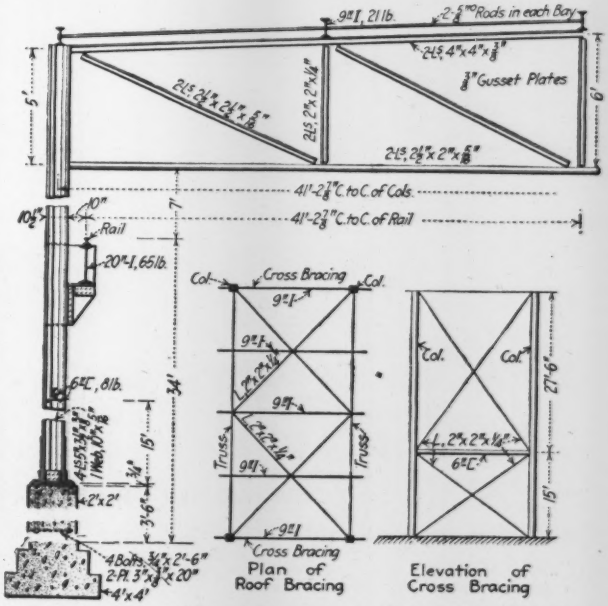
Crane Runway Columns Extended To Carry Roof

Material Yard at Chicago Foundry Will Have Cover Framing Into Posts on Which Crane Girders Are Supported

A YARD crane with supports designed to carry a roof over the yard is an interesting feature of the new foundry plant for the James A. Brady Co., at Chicago. The material yard is between two buildings and is served by a 5-ton electric traveling crane of about 41-ft. span and 30 ft. above the ground.

The crane runway consists of 20-in. I-beams carried by brackets upon columns about 42 ft. high, which are connected by transverse trusses. The construction is shown by the accompanying drawing. The runway is 180 ft. long, with columns and trusses spaced 20 ft. c. to c. The columns are of H-section, with a 10-in. web plate (transverse to the runway) and four angles 5 x 3½ in. The truss members are all composed of pairs of angles. Longitudinal bracing is provided by a double line of 6-in. channels (forming an inverted T-section) between the columns, at a height of 15 ft. above the ground. There are also five lines of I-purlins along the roof, upon which will be laid the plank sheathing. Horizontal and vertical diagonal bracing is provided in three of the bays. This consists of single angles 2 x 2 x ¼ in., arranged as shown, the horizontal bracing being in the plane of the top chord of the trusses.

This design not only provides for putting the yard under roof, but also saves yard space by allowing ordinary columns to be used. Crane runways having no transverse bracing usually require large supporting bents to give the necessary lateral stability. The architect is S. Scott Joy, of Chicago. He has introduced a similar construction in other industrial plants, as it has been found that the covered yard increases the efficiency of the work, eliminating the bad weather delays.



THIS RUNWAY FOR A YARD CRANE IS DESIGNED TO CARRY A ROOF

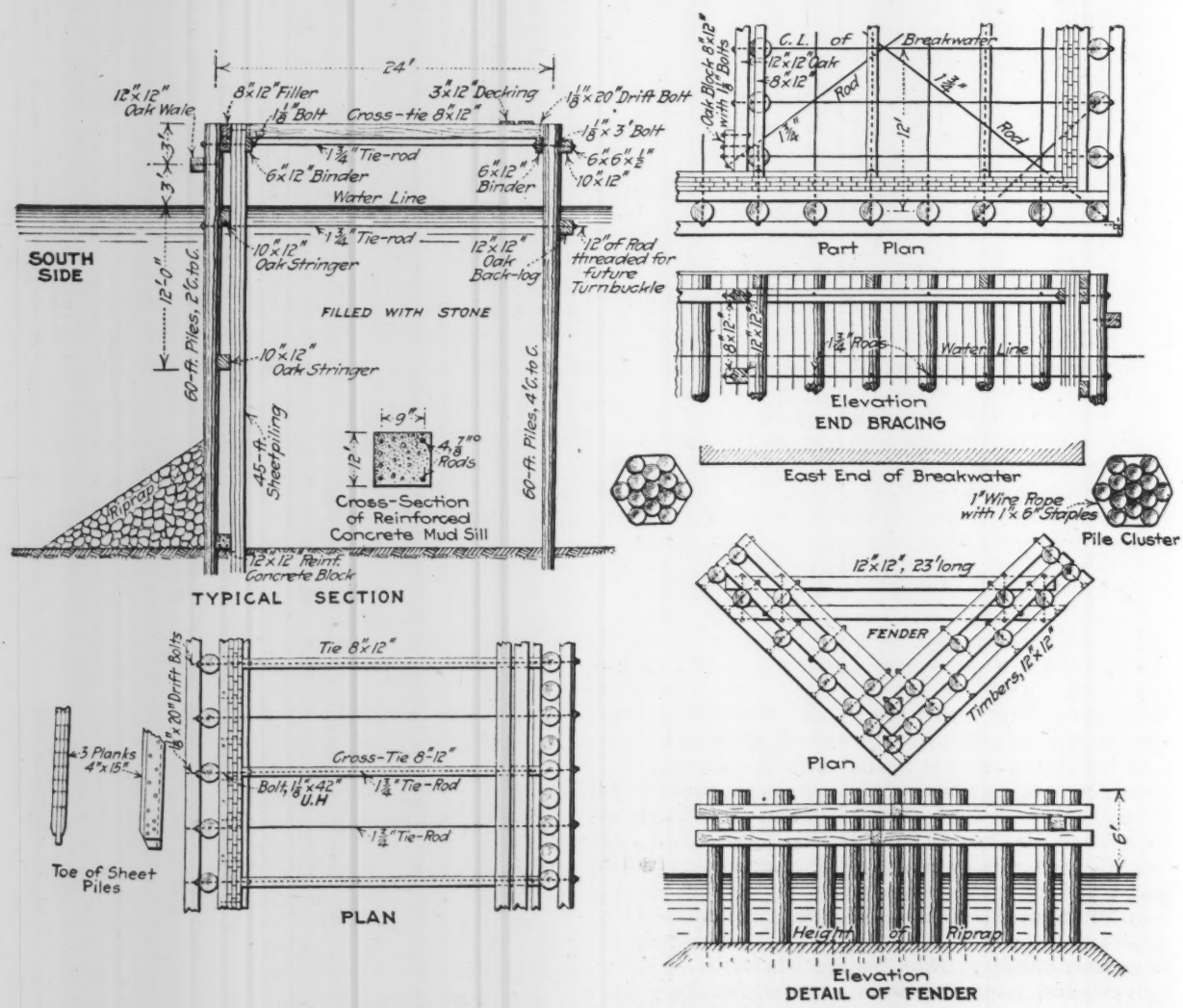
Breakwaters Protect Chicago's Municipal Pier

Rock-Fill Between Rows of Piles Forms Barrier Inside Main Breakwater and Provides Still Water Around Pier

TWO breakwaters have been found necessary to protect ships docked along the exposed length of Chicago's new 3000-ft. Municipal Pier. It is partly protected on the north and east by Government breakwaters, but the area inclosed by these is so large that considerable sea is developed at the pier. The city, therefore, has built a rock-fill pile breakwater 2350 ft. long, 600 ft. south of the pier, and proposes to build this year a similar breakwater 2000 ft. long, 500 ft. north of the pier. These breakwaters are parallel with the Municipal Pier and will form the dock walls of other piers when the growth of lake traffic makes such additional accommodation necessary. They may be extended as required.

The construction of the south breakwater is shown in the accompanying drawing. There are two rows of 60-ft. wood piles, 24 ft. c. to c. The piles in the north row are spaced 2 ft. c. to c. and those in the south row, 4 ft. c. to c., the latter being backed by 4-in. Wakefield triple-lap pine sheet piling 46 ft. long. An unusual feature is the use of a 12 x 12-in. precast reinforced-concrete mudsill on the lake bed as a bottom stringer between the round and sheet piling. This mudsill has the advantage of being easily placed and does not have to be held in position pending the driving of the sheet piles. The mudsills and stringers are in 34-ft. lengths, with ends lapped behind a pile. The reinforcement of the mudsills made then very stiff, and they were handled easily by a derrick having a sling attached to a single cable. They were adjusted to position by a diver, whose signals controlled the movements of the derrick.

The rows of round piles are connected by two systems of transverse 1¾-in. tie-rods. The lower rods are 1½ ft. below water and spaced 4 ft. c. to c. The upper rods are 4½ ft. above water and 8 ft. c. to c. These rods pass through the piles and have nuts and washers bearing directly on the piles of the front row and on waling timbers outside the piles of the rear row. Spaced between the top tie-rods and fitted tightly be-



BREAKWATERS PROTECT CHICAGO'S 3000-FOOT MUNICIPAL PIER

tween the two rows of piles are 8 x 12-in. transverse pine ties resting on and driftbolted to the longitudinal 6 x 12-in. binder on each pile row. Upon these joists is laid a walk of two 3 x 12-in. planks. Eventually, the entire width will be decked over and the breakwater used as an unloading pier for small freight boats.

The space between the rows of piling is filled with hand-size stone deposited by means of boxes and derrick, and also by dump scows and dredge. Deep water was encountered at both ends of the breakwater, the maximum depth being 38 ft. and the minimum 18 ft. At all points where the depth of water exceeded the width between rows of piles (24 ft.), stone was dumped on each side of the breakwater and brought to within 18 ft. of the water surface alongside the pile rows to insure stability.

The top rods were first placed, and then stone was dumped into the breakwater and brought up to within 2 ft. of the lower tier of rods. These rods were then placed and the stone-fill brought up to final grade. In deep water, the riprap stone was carried up simultaneously with the filling stone to prevent sliding at the toe of piles due to excessive stone-fill. After the stone-fill was leveled off to proper elevation, the cross-ties were placed and the longitudinal planking laid. About 90,000 cu.yd. of stone was used as riprap and filling.

At 24 ft. from each end is an interior transverse row of piles, with back-logs for two tiers of diagonal rods to the corners. Diagonal tie-rods are also put across the corners, as shown. At the east (or outer) end of the breakwater is a pointed fender having two rows of 60-ft. oak piles and wales with timber struts across the angle. On each side of this is a cluster of 13 oak piles 60 ft. long, bound with 10 turns of 1-in. wire rope, secured by galvanized staples 1 x 6 inches.

The lake bottom along the line of the breakwater was found to be variable, both as to depth and character. This is due to the fact that the filling of the Municipal Pier was done by a hydraulic dredge, which caused deep holes wherever it worked. The bottom consists of 3 ft. of sand and 5 ft. of soft mud overlying the stiff clay of the lake bed.

The south breakwater was designed and its construction superintended by Percy R. Hynes, assistant engineer, under the direction of Adam F. Weckler, harbor master (representing the Harbor and Subway Commission). It was built by the Great Lakes Dredge and Dock Co. at a cost of about $250,000. Plans for the north breakwater of similar construction have been completed, and work will be started this summer.

Steam Tender Increases Hauling Power of Locomotive

Placing of Old Engine Frame and Cylinders Under Tank Gives Modern Engine More Capacity with Less Fuel Consumption

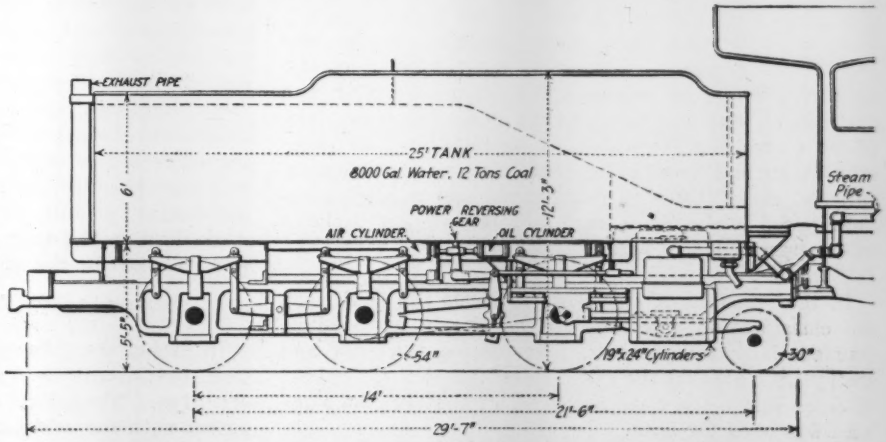
OLD ENGINES retired from service are being utilized by the Southern Ry. as steam tenders to increase the power of modern locomotives. The new freight engines thus equipped are of the 2-8-2 class, with cylinders 27 x 30 in. and 63-in. driving wheels. They weigh 136 tons, with 109 tons on the drivers.

The old engines now converted into tenders are of the 2-6-0 and 2-8-0 classes. One of the former is shown in the accompanying drawing. The boiler is removed and replaced with a tender tank carrying 8000 gal. of water and 12 tons of coal. Pipes with flexible connections lead from the steam chests to the superheater on the engine, and provision is also made for taking live steam direct from the boiler when necessary. The exhaust is carried to a vertical pipe at the rear of the tank. A power-operated reversing gear is applied and is controlled from the cab. A steel casting is placed between the frames at the forward end for the drawbar connection to the engine, and a similar casting at the rear end carries the coupler and draft rigging.

The 2-6-0 tender has 54-in. driving wheels and 19 x 24-in. cylinders. Its weight, loaded, is about 76 tons, with 62 tons on the drivers. With this power-operated tender instead of the ordinary tender, the drawbar pull of the engine is increased more than 33%, and the engines haul 1400 and 1600 tons where they formerly hauled 1100 and 1200 tons. At the same time the coal consumption per 100 ton-miles is reduced to about 12 lb., as compared with 18 lb. for the new engines without steam tenders and hauling the lighter loads.

The conversion of the old locomotives into steam tenders was done at the railway company's shops. Seven large freight engines are now equipped in this way.

This method of increasing the power of locomotives is the revival of a very old idea to meet modern conditions, the plan having been employed to a small extent in England many years ago. The recent triplex Mallet engines also have steam tenders, but in these the engine and tender form a complete new unit.



THIS OLD LOCOMOTIVE CONVERTED INTO A STEAM TENDER ENABLES MODERN ENGINE TO HAUL GREATER LOADS

Making Industrial Valuation for Tax Purposes

Appraisal of Machinery and Equipment Made Quickly in Buffalo Raises Some Assessments and Lowers Others

By GEORGE E. BARROWS
Of Ellsworth, Barrows & Reeves, Engineers, Buffalo, N. Y.

SIXTEEN thousand pages of field notes were taken last year in an appraisal of the buildings, machinery and equipment of Buffalo's industrial plants. In nine months 450 plants were covered, valued at $60,000,000. The work cost 42c. per $1000 of depreciated value. By it was made possible such an equalization of assessments between steam and electric plants, and between all manufacturing plants and other taxable property, as had not before existed. The records are permanent and can easily be brought up to date at any time.

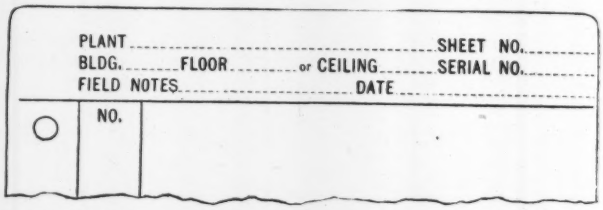
The tax law in the State of New York, as interpreted by the courts, holds that fixed machinery and equipment are real property. While there have been numerous attempts to place this value on assessment rolls, the efforts have not been very successful, since in most instances only power-plant equipment was included. Thus the intent of the statute was not fully carried out, and the tendency was to secure poor equalization, in that steam power-plant equipment was included wholly or in part, while electrical-unit drive was overlooked entirely. Therefore, in order to carry out the law impartially, and with the hope of having the manufacturer share equally with the small taxpayer in bearing his fair share of the city's expenses, Charles B. Hill, commissioner of finance and accounts for the city, undertook a general revaluation of all property in the city, and the writer's firm was retained to cover the industrial plants. The work was to include a valuation of the manufacturing buildings as well as the equipment contained in them

Twenty-Two Groups of Industries

The first endeavor was to classify all the industries of the city into 22 groups, as follows: Iron and steel, large metal-casting plants, foundries and machine shops, structural steel, automobile and marine motor construction, miscellaneous light manufacturing, newspapers and printing plants, breweries, meat-packing plants, laundries, bakeries, woodworking, stone crushing and cutting, oil and chemical plants, soap factories, telephone companies (exclusive of special-franchise property), flour and cereal mills, grain elevators, malthouses, railroad shops, banking institutions and miscellaneous industries. Since there were approximately 450 plants to be appraised, this arrangement was found very helpful.

In the selection of engineers to cover the field work the classification was followed as closely as possible. One specially trained man investigated the iron and steel plants, another the grain elevators, etc. Of course, in cases where one class bordered on another, the same man was used for both.

In getting the field work, it was necessary to have the description of the different items of equipment made swiftly and accurately, and at the same time in such a form that the office work could be carried on rapidly. Field note blanks of the form shown were found very useful in standardizing this part of the work. The loose-leaf system gave splendid results, not only because of the convenience to the field engineer, but also because of the ease with which the notes covering each plant could be permanently bound together. Each sheet, when filled out, gave the name of the plant inspected, the number of the building and the location of the items of equipment on the floor or ceiling, as the



THIS NOTE FORM FACILITATED THE FIELD WORK

case might be. The notes for each floor or ceiling were accompanied by a location sketch showing the relative position of the machines on that story. For instance, a machine might have the number B-3-26, which would mean that it was located in Building B, on the third floor, and its position on the floor would be indicated by the figure 26 on the location sketch.

Upon the completion of the field work, the name of each machine with its identifying number was transferred to the record sheets, upon which the cost of the item, the charge for installation (which included freight and handling), the depreciation and the present value were shown. These record sheets for each plant were turned over to the city and constitute a permanent appraisal, so that at any time in the future it will be possible to check over each plant and quickly make a record of the alterations that have taken place.

As suggested, the field engineer also made building measurements and described the construction fully, giving structure of walls, type of floor, ceiling and roof, and any other details which would be necessary in establishing a unit price. The building costs were worked up on the cubic-contents basis, and depreciation was reckoned by the straight-line method.

Descriptions of Machines Made

In listing the different items of equipment, the engineer was instructed to make a concise but thorough description. The name of the machine was given, together with the model number and serial number where possible. Sizes and measurements were also taken and the condition was noted. Wherever a special founda-

tion was used, its construction and size were shown. The size and length of all main-line shafts were given, as well as the number of hangers and their size, and the diameter, face and material of pulleys. Of course, it was necessary to estimate these sizes from the floor, but this can be done very rapidly and with a surprising degree of accuracy by a trained man.

In case of special machinery, especially that made by the company appraised, the weight was also estimated. It was also found advisable in the case of many machines of small value to have the engineer estimate the present value in the field. It will be readily understood that since this work was for taxation purposes, the aim was to arrive at a fair, conservative present worth, rather than to go into such detail over petty items that the cost would be prohibitive.

In the adoption of unit costs, great care was taken to avoid using figures that would not be maintained over a period of years; that is, in no cases were inflated prices due to the war used, but only those which would reflect normal trade conditions.

Sprinkler systems for fire protection were not figured as equipment, but as part of the building construction and included in the unit price per cubic foot. This statement also applies to electric lighting and steam piping, but sprinkler tanks, switchboards and all separate items of equipment were taken.

Installation Costs Averaged

The charge for installation of machines was figured according to installation curves rather than for each machine. The curves represented the average costs of installation for varying machine costs; that is, the abscissas on the curve were the typical machine costs and the ordinates the average charge for installation, which included freight, carting, handling and setting. This method was necessary because of the time limitations, but it was also the only practicable way in which fair equalization could be secured. For instance, one company might have a hammer on which installation charges would amount to 15% of the cost, owing perhaps to lack of crane facilities in the building and to natural difficulties to be overcome in getting it into the building; while another plant might be using the same hammer on which the installation charges might have been only 5% of the cost.

Although in strict accounting the actual conditions under which the machine was set up would have to be considered, it was not thought equitable to tax any manufacturer for a misfortune. This applied also to freight charges. Whether a machine came from Chicago or Boston, other things being equal the installation charge would be the same, and it was found that the law of averages gave very close results.

Straight-Line Depreciation for Buildings

Depreciation presented no difficulties so far as buildings were concerned, for the well-established custom of using the straight-line method was followed. For buildings of permanent construction 2% and for those of frame and less permanent construction 3% was used. There were no practical difficulties in applying this method, for the field engineers learned the ages of the buildings in almost all cases from the owners, and their figures could be easily checked.

Depreciation of equipment was less readily taken care of, partly because of the uncertainty among appraisal engineers as to the principles involved, but also because of the special character of the work which was being done. The straight-line method could not be used for several reasons. In the first place, it was manifestly impossible to go into a minute description of each machine, and the difficulties in the way of getting the ages of the various items of equipment, although not insuperable, would have necessitated such an expenditure of time and effort that the cost would have been out of all proportion to the results obtained. And at best, the results would have been of questionable value, for in numerous instances machines were found that had been used for a great many years and kept in first-class condition, machines which were certainly not in the minimum-service class. Then there were practically new machines in good condition, on which only a small fraction of the original cost could be realized, because of obsolescence through the adoption of more practical machines, requiring less labor to run or running more efficiently.

Another method which was considered but not adopted was that known as the deferred-maintenance method. Here again, it was a question of results. The engineer might, by spending a great deal of time, decide just what cost would be necessary to bring each machine to perfect condition. But disregarding the arbitrary nature of the results thus obtained, obsolescence would still have to be considered, and in many cases this constitutes more of a factor in depreciation than the physical condition of the machine.

Equipment Depreciated by Average-Condition Method

What was finally decided upon was what might be called the average-condition method. Without presenting the case for this method, it may be well to show how it applied to the work in hand. In practically all of the 450 plants, this is what was found. There were machines in use which had been running day after day for several years, and although still doing the work, were about ready to be discarded. On the other hand, there were machines which were practically new, and the balance varied more or less uniformly between these extremes.

Of course, some classes of machines depreciate much more rapidly than others, and there are some that can be almost rebuilt again, part by part. Thus a spinning machine may be used year after year, and as a part becomes worn, it is replaced by a new one. Then again, the main part of some machines consists of a solid framework which lasts indefinitely, and the moving parts which are attached to it are replaceable, so that aside from obsolescence the depreciation would be small.

With these facts in mind, a figure was sought which would represent the average condition of the equipment in a plant having machinery in all states of efficiency. In a typical factory of this class the average was found by considering the value of a new machine as 100% and the value at minimum service as 30%. This would give an average condition between these extremes of 65%, but to be conservative only 60% was used. Electrical equipment, being kept in better con-

dition than other classes and having a greater residual value, was on the average depreciated 30 instead of 40%.

Since a statement of the condition of each item of equipment was available (this being one of the things noted by the field engineer), it was possible and often necessary to treat plants which were out of the ordinary in a special way. For instance, there were a few very old concerns in the city, in which the equipment was well under average condition, and these had to be handled on their merits, machine by machine. The same reasoning applies to concerns in which all of the machinery had recently been installed. Thus justice was not only accorded individual plants, but a fair equalization was maintained among all the plants.

Results of the Work

It is still rather early to discuss the results of the work fully, but there are some general deductions which may be of interest. It may first, however, be interesting to note that, since the work was done for taxation purposes, it was especially gratifying that the field engineers were enabled to make their inspections with so little opposition on the part of the manufacturers. In practically all instances they were received courteously and given every assistance necessary in making the appraisal.

As has been intimated, one of the objects of the work was an equalization among the different plants to redistribute the burden, so that each would bear its share of the tax but no more. In some cases a reduction in the assessed valuation was recommended; on the other hand, there were firms that were greatly under-assessed and thus escaping their fair share of the tax. By the correcting of inequalities of this kind, all plants were placed on substantially the same basis.

Another important result of the work was an equalization as between the manufacturers and other taxpayers, which followed the placing of the taxable, but hitherto untaxed, equipment on the roll.

These are a few figures showing some of the results:

Duration of the work	9 months
Pages of field notes	16,000
Number of plants valued, about	450
Approximate cost of reproduction, buildings and equipment	$107,000,000
Present value, buildings and equipment	60,000,000
Cost of valuation, based on reproduction	25c. per $1,000
Cost of valuation, based on present value	42c. per $1,000

The work in Buffalo is especially interesting as showing the possibilities of the application of scientific valuation to the settlement of municipal problems of taxation, for while the whole subject of taxation is still in an indeterminate state after centuries of discussion, there are signs that communities in all parts of the country are groping for a solution. The method adopted here is at least valuable for comparison.

Water Company Follows Through on Thrift-Garden Effort

Not content with promoting the establishment of gardens on 4500 vacant lots—approximately 325 acres—and giving the water to irrigate them free, the Denver Union Water Co. is now giving service to the householders through Prof. P. L. Clarke in the way of advice as to how to cope with pests as well as how to can and put away the surplus crops for winter use.

Step Baffles Hold Hydraulic Fill Placed Under Pier

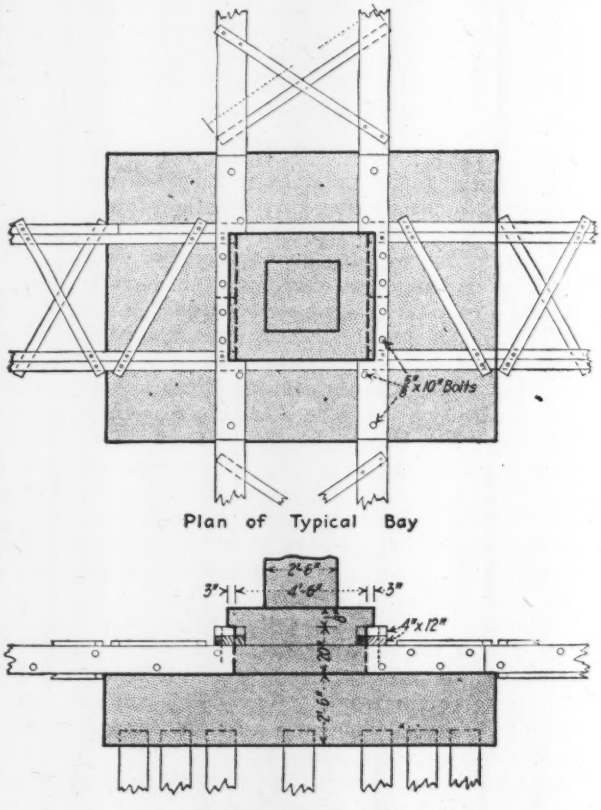
Single-Wall Wood Sheet-Pile Cofferdam 186 by 825 Feet Successfully Pumped at New Orleans Dock

By P. B. Burkhalter

Jacob A. Zimmerman & Son, Inc., Constructing Engineers, New Orleans

Additional fill under the wharfhouse unit of the cotton warehouses and terminals being erected for the Board of Commissioners of the Port of New Orleans was placed behind a series of stepped baffles after the footings, columns and diagonal bracing were in place.

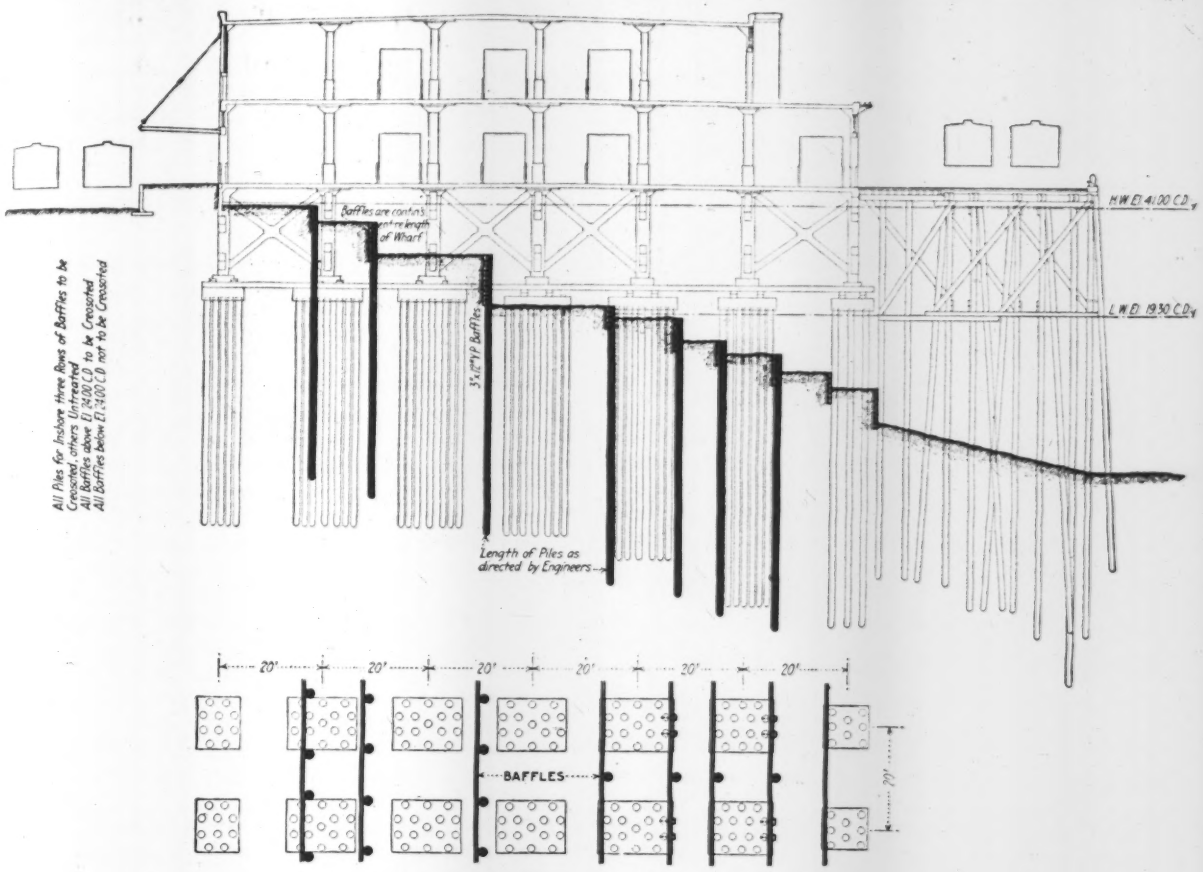
The piledriving was started in August, 1915, with the river stage 15 ft. above the pile cutoff, and in approximately 40 ft. of water. These conditions necessitated using a pile follower on 9000 piles. This driving was completed in January, 1916, after considerable difficulty owing to the fact that the high water continued practically the whole year. Because of the continued



FOOTINGS BRACED AGAINST EACH OTHER

high water the contractor was forced to abandon further operations until the stage of the river permitted the construction of the foundation.

In August, 1916, was started one of the largest single-wall sheet-pile cofferdams ever constructed—186 x 825 ft. The Martinez type of interlocking sheet pile was used. Owing to the overhang of the apron wharf adjoining the work, it was necessary on that side to drive


All Piles for Inshore Three Rows of Baffles to be Creosoted, others Untreated
All Baffles above El. 3.00 C.D. to be Creosoted
All Baffles below El. 7.00 C.D. not to be Creosoted
Baffles are continuous the length of Wharf
3"x12" P. Baffles
Length of Piles as directed by Engineers
H.W.El. 4.00 C.D.
L.W.El. 1.30 C.D.
20'
BAFFLES
20'

BAFFLES RETAIN SLOPING FILL UNDER WHARF

in a slanting position 825 ft. of completed dam, and then jet and pull it into place. A single wale, 10 x 10 in., U-bolted through each sheet pile, constituted the only reinforcement.

One 6-in. and two 8-in. centrifugal pumps were used in unwatering the cofferdam, and the sheet piles were found to be so tight that the site was practically dry, except for a small amount of seepage, after 12 hours of pumping.

After the cofferdam was pumped out, it was decided to accept a new footing design requiring about 100,000 cu.yd. of fill, which necessitated the cofferdam acting as a bulkhead also. During the construction of the foundation to the first-floor elevation the head of water varied from 3 to 7 feet.

Baffles Placed by Divers

The footings, columns and diagonal bracing were completed in February and actual operations suspended to allow additional fill of approximately 250,000 cu.yd. to be made. This fill is held in place by a series of step baffles that were placed on 10-ft. centers from El. 8, about at river bottom, to El. 42. Perhaps 75% of these baffles were placed under water by divers who sank 60 ft. of completed baffle per shift. The baffles were made of 3 x 12-in. long-leaf yellow-pine planks, which were battened together and pulled under by means of crabs on small barges. When sunk to the required elevation, they were bolted around the piles with U-bolts.

A unique feature of the design is the horizontal timber trusses that tie the footings to take care of lateral movement. This timber has a 12-lb. treatment of creosote. There are no connections or anchors to the footings, although a 3-in. lip is provided on the column pedestal that acts as a wedge, which is so designed as to form a brace to take the place of a concrete girder.

The port commissioner's dredge "Dixie" is making the fill under the supervision of Ford, Bacon & Davis, supervising engineers, who designed the cotton warehouses and terminals. The general contractors are Jacob A. Zimmerman & Son, Inc., New York City. For them W. E. Thursby is superintendent, and the writer is constructing engineer.

Government Can Now Make Optical Glass

The Bureau of Standards of the Department of Commerce, after two and a half years of continuous study and experiment, has achieved satisfactory results, and is prepared to produce optical glass. Additions are now being made to the working plant requisite to permit larger production to supply the needs of the Government. The matter is one of essential importance to the military services of the nation. Heretofore this material of the best grade has been wholly made in Germany; but the United States is henceforth independent of any foreign supply for this most important product.

Another Jump in Duty Record of Turbine Centrifugal Pumps

New Toronto Unit Showing 153.92 Million Foot-Pounds per 1000 Pounds of Steam, Eclipses Montreal Machine

A TWENTY-FOUR-INCH steam-turbine-driven centrifugal pumping unit installed in the John St. station of the Toronto (Ont.) water-works has established a new duty record of 153.92 million foot-pounds per 1000 lb. of steam, thus exceeding the performance of the much-discussed Montreal turbine unit. (See *Engineering News*, Nov. 2, 1916.)

Toronto Installs Five Centrifugals

The City of Toronto has installed five large centrifugal units, partly superseding and partly supplanting miscellaneous older equipment. The first new unit comprised a 1400-hp. turbine driving through gears two 24-in. centrifugal pumps. The acceptance test on this unit, as conducted Nov. 30 and Dec. 1, 1914, by Prof. R. W. Angus, of the University of Toronto, showed a capacity of 18.373 million Imperial gallons per day against a net pressure of 114.1 lb. per sq.in. The duty was 137 million foot-pounds per 1000 lb. of steam (at 137.4 lb. gage at the nozzle, 1.05% moisture and 28.94 in. corrected vacuum) excluding auxiliaries.

Early in 1917 two similar units, but of 24 million gallon capacity, were installed and two smaller units were purchased. One of the larger units was tested by Professor Angus on Mar. 8, 1917, yielding the new performance data shown below.

The two pumps of the unit are single-stage, double-suction types, connected in series. The condenser has 1300 sq.ft. area of 1-in. brass tubes, and passes all the water received by the pumps. The air pump is of a wet-vacuum type, and condensate is delivered from hotwell to boilers by a triplex pump, chain-driven from the main unit (and requiring about 6 hp.). No feed heater was used, and the exhaust from the air pump was introduced into an intermediate stage of the main turbine. Cooling water for bearings and oil tank was taken from the discharge of the first pump—40 gal. per minute.

The Penalty and Bonus Clauses

The manufacturer, the De Laval Steam Turbine Co., of Trenton, N. J., guaranteed a capacity of not less than 24 million Imperial gallons per 24 hours against a pressure of 107 lb. per sq.in. measured between suction and discharge mains, and a duty of 141.5 million foot-pounds per 1000 lb. of steam (containing less than 1½% moisture) including that used by jackets and auxiliaries. A penalty was fixed of $2500 per million foot-pounds below the guarantee and a bonus of $1500 was allowed per million foot-pounds above.

Acceptance Test of Large Pump

The accompanying figures on the Angus test were furnished by the manufacturer. The discharge pressure was taken on the 24-in. pipe close to the pump flange; the suction pressure was taken on the 42-in. main immediately in front of the condenser. No allowance was made for friction or added velocity head.

The maker has made extensions of the Angus test, to obtain duty figures for the bare unit so that they may be compared with the performances of earlier machines. Readings during the official test showed that the friction and increase in velocity head between the 42-in. inlet to the condenser and the 24-in. suction nozzle of the pump was 4.77 ft. (a tapering enlarger connected the 24-in. pump outlet to the 36-in. delivery main of the city) and the difference in pressure head between the two ends of this enlarger was found to be slightly over 2.71 ft.—though this does not enter the official figures of the complete unit or the extended figures of the bare turbine and pump.

SUMMARIZED RESULTS OF TORONTO PUMP TEST, MAR. 8, 1917

Average boiler pressure, lb. per sq.in., gage	148.4
Steam pressure at turbine, lb. per sq.in., gage	144.6
Moisture in steam at turbine, %	0.55
Vacuum in exhaust chamber, in.	28.69
Barometer reading, in.	29.43
Vacuum referred to 30 in. barometer	29.20
Net pressure produced by pump, lb. per sq.in.	107.18
Discharge as measured by Venturi tube and mercury column, million gal. per 24 hr.	25.1
Corresponding water horsepower	1306
Steam used per water horsepower, lb.	12.88
Duty in million foot-pounds per 1000 lb. of steam	153.92

For the duty figures of the bare unit, the net pressure (107.18 lb.) was increased by the 4.77 ft. friction and added velocity head in the pump approach. The water horsepower was further increased by the power put into the 40 gal. per min. cooling water, drawn from the first pump at half the net pressure produced by the unit. An allowance of 6 b.hp. was made for the work of driving the boiler feed pump, and account was taken of the work secured in the low-pressure end of the turbine by the 680 lb. of steam exhausted by the air pump (this figure being found by separate test).

The resultant figure for the bare machine is 160.5 million foot-pounds per 100 lb. of steam.

What the Toronto Pump Could Do

With the energy available by the expansion of a pound of steam from 144.6 lb. gage to 0.74 in. mercury column, taken as 367 B.t.u., or 285,446 ft.-lb., and comparing this with the delivery of 160,500 in the water handled, an overall efficiency of 56.4% is indicated, neglecting the slight amount of moisture in the steam. Taking the total heat in the steam at 144.6 lb. gage over that in the condensate at 66° F. as 1160 B.t.u. per pound, the duty expressed in million foot-pounds per million B.t.u. supplied becomes 138.4. It will be recalled (see *Engineering News*, Nov. 2. 1916) that the actual duty of the Montreal pump under test conditions was reported finally as 126.2, and this corrected for the proper superheat under which the unit was intended to operate gave a probable duty of 134.6.

The manufacturer of the unit claims that if the Toronto machine were arranged for bleeding steam for feed-water heating, as was the case in the Montreal unit, and sufficient steam were bled in addition to the 680 lb. of steam exhausted from the auxiliaries to heat the feed water to 210° F., the duty of the bare machine without superheat would have run up to 144 million foot-pounds per million B.t.u. It is also claimed that if the steam were superheated 100° F. and sufficient steam were bled from the turbine in addition to that secured from the auxiliaries to heat the feed water to 210° F., the duty would become 152 million foot-pounds per million B.t.u.

California Reservoirs Silt Up Slowly

Sweetwater, Lake Chabot and La Grange Reservoirs Show Little Capacity Loss

By EDWARD BOWEN

Offices of J. B. Lippincott, Consulting Engineer, Los Angeles, Calif.

THE building of dams across mountain streams is not unusual; most reservoirs are created in this way. The gold miners in the Sierras of California did it 50 years ago on Yuba and Feather Rivers, and many of their reservoirs are still in service.

The rate at which silt is deposited in a reservoir depends upon the quantity carried by the stream, the size of the reservoir, the volume of stream flow and the character of the drainage basin. If the capacity of the reservoir is small compared with the average annual discharge of the stream, it acts in the nature of a retention basin and when the stream is in flood and carries its greatest silt load, a portion of the silt is wasted by the dam. On the other hand, if the reservoir capacity is large compared with the average annual stream flow, little waste occurs and all the silt transported by the stream is deposited in the reservoir.

If the rock structures in the drainage basin are hard (such as granites and sandstones) and the hillsides and flats are covered with brush and timber, the storms do not erode badly and the stream carries little silt. If the hills are of soft material such as shales, adobes or loam, the brush cover sparse and there are large areas of plowed or cultivated land, the stream will be heavily silt laden.

Mountain streams in California as a rule carry little silt. The existence of glacial lakes in the High Sierras is absolute evidence of the absence of silt in the streams running through them. If there were silt in these streams in large quantities, there would be no lakes.

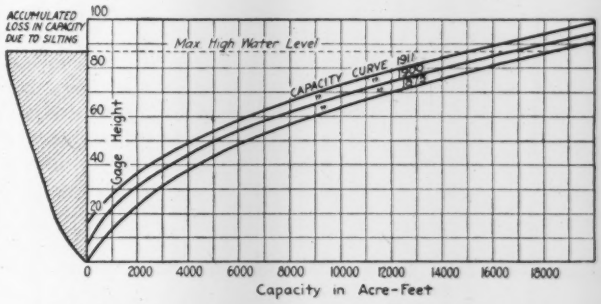
Experience has shown the silting of artificial reservoirs in California to be an extremely slow process. There are available records of the Sweetwater Reservoir and Lake Chabot on San Leandro Creek. Both are on torrential streams that produce comparatively large quantities of silt.

Sweetwater Reservoir Lost Only 4% of Capacity in 12 Years

The Sweetwater dam, near San Diego, Calif., was constructed in 1887 across the Sweetwater River. Twelve years afterward the reservoir became empty through conditions of drought. It was determined from surveys made at that time that 900 acre-feet of silt had been deposited in the 12-year period. The average run-off of the Sweetwater River is about 13,000 acre-feet per annum, the capacity of the reservoir 22,000 acre-feet, and the average annual withdrawals therefrom about 11,000 acre-feet. The drainage area is 186 square miles, of which about one-third to one-half is covered with brush and timber. There are large amounts of plowed and pasture land with light soils. The average annual run-off of the stream is only about one-half the capacity of the reservoir, so that only occasionally water is wasted, and practically all the suspended matter carried by the stream is deposited in the reservoir. This condition is particularly favorable to rapid silting. The survey showed that the silt deposits are at the rate of 0.5% of the volume of water entering, or in 12 years it lost 4% of its capacity.

Only 16½% Lake Chabot Capacity Lost in 36 Years

Lake Chabot, a part of the water-supply of the East Bay Water Co., Oakland, Calif., is created by a dam built in 1875 across San Leandro Creek. An accurate topographical survey was made of the reservoir site



CURVES BASED ON ACTUAL SURVEYS SHOW SILTING OF CHABOT RESERVOIR FROM 1875 to 1911

at the time the dam was built. Other surveys were carefully made by sounding in 1900 and in 1911. The last survey showed a deposit of 3100 acre-feet of solids during the period of 36 years since the construction of the dam. The average annual run-off of the stream is 21,700 acre-feet. It is torrential in character, carrying large floods immediately following the winter rains and going entirely dry during the summer months. The capacity of the reservoir is 15,000 acre-feet, so that the reservoir is in the nature of a detention basin, the large floods being wasted through it. The drainage area consists of 42 square miles, about one-third of which is brush covered, one-half unplowed bare fields and probably one-sixth cultivated land. The soils range from a sandy loam to adobe. They are friable, and the drainage basin is one that produces large quantities of silt. The stream is particularly muddy throughout the rainy season. During the 36-year period the deposits of silt amounted to 0.4% of the stream flow, or the reservoir lost 16½% of its capacity. The accompanying diagram of the capacity curves for Lake Chabot shows the accumulations of silt as determined by surveys.

It is interesting to note that 39% of the deposits occurred in the extreme bottom of the reservoir next the dam. The deposition of a large proportion of the silt near the dam was also evident in the silting of the Sweetwater reservoir.

The peninsula reservoirs of the Spring Valley Water Co., San Francisco, have been in service for over 40 years, and no reductions have been made in their computed capacities because of the deposits of silt. Although no surveys of these reservoirs are available, those who are familiar with them state the silting is negligible.

Sedimentation Survey of La Grange Reservoir

An observation to determine the rate of sedimentation was made at the La Grange reservoir, on the Tuolumne River, by J. B. Lippincott for the Hydrographic Branch of the United States Geological Survey. The Tuolumne River is a typical Sierra stream draining the western slope of the Sierra Nevada in central California. The drainage area above the dam is 15,000 square miles, the greater portion of which is in the Yosemite National Park. The basin is heavily forested up to a 9000-ft. elevation. From there up to the crest of the range, which reaches to 13,000 ft., there are large areas of bare granite rock and numerous alpine meadows. Glacial lakes occur above 5000 ft. In the lower portion of the river are a few old gold stamp mills, the tailings from which are washed into the channel of the stream above the reservoir. The La Grange dam was built to divert the Tuolumne River into the Turlock and Modesto irrigation canals. It is an overflow type 120 ft. high. The reservoir is long and narrow, and its capacity compared with annual discharge of the stream is small. In 1895 a topographic survey of the reservoir site was made. In October, 1905, a second survey was made by Edward Johnson for the Geological Survey.

From Oct. 1, 1895, to Nov. 1, 1905, a period of 10 years and one month, 1264 acre-feet of silt were deposited, or 54.2% of the capacity of the reservoir.

Little or no precipitation occurs in the drainage basin between the first of April and the first of October.

LOSS IN CAPACITY OF LA GRANGE RESERVOIR, CALIFORNIA BY SILTING IN 10 YEARS

Contour	Area, Acres	Capacity, Acre-Feet	Area, Acres	Capacity, Acre-Feet
	In 1895		In 1905	
300	56.12	2,332.3	54.1	1,068
299*				1,914
290	48.90	2,060.8	39.6	600
280	42.07	1,571.8	21.3	296
270	33.83	1,151.1	12.1	129
260	25.97	812.8	6.0	39
250	21.45	553.1	1.2	3
245			0.0	0
240	16.67	338.6	.....	.....
230	9.55	171.9	.....	.....
220	6.66	76.4	.....	.....
210	0.41	9.8	.....	.....

*Crest of dam in 1905

During the winter months precipitation is in the form of snow, the melting of which produces summer floods.

The discharge of the river from Oct. 1, 1895, to Nov. 1, 1905, was 18,809,707 acre-feet. According to the surveys, the deposits of solids in the reservoir accumulating between these dates was 1264 acre-feet, or at the rate of 0.0067% of the stream flow.

The above data are interesting to hydraulic engineers as indicative of the small percentage of the stream flow that is deposited as silt in reservoirs. One is frequently confronted with the statement that the construction of a reservoir is prohibitive because of the muddy character of the stream and the consequent rapid accumulations of silt. Although this is true to some extent on muddy streams, such as the Rio Grande and the Colorado, it is a relief to know that there are some streams in California which refute this.

Bascule Bridge Is Erected as a Cantilever

Double-Leaf Market Street Structure at Chattanooga Placed by Means of Traveler Mounted on Deck of Span

By W. J. Howard
Engineer, Kelly-Atkinson Construction Co., Chicago

THE erection of a 300-ft. double-leaf rolling-lift bascule span as a pair of cantilevers, in order to avoid the use of falsework, was one of the most interesting features in the recently completed construction of the Market St. bridge at Chattanooga, Tenn. The bridge is about 2300 ft. long, including the approach fills. Besides the 300-ft. steel drawspan, it has five reinforced-concrete arches of 180-ft. span and two of 165-ft., besides nine 40-ft. concrete-slab spans. The accompanying views show some of the stages of the work.

Drawspan Erected in Closed Position

The steel drawspan was erected in its closed position (*A*, Fig. 1) by means of a timber traveler having a 55-ft. boom and a 32-ft. mast at one corner of its 20 x 40-ft. frame. It was mounted on rollers and pulled ahead by a manila runner line as required (*B*, Fig. 1). The traveler was placed at one side of the deck (between the lower chords of the trusses), so that the push-car with material could be brought to it and the boom swung to pick up the material and erect it in place without shifting the traveler.

The three-drum, 30-hp. American hoisting engine (with cylinders 8½ x 10 in.) was mounted at the rear of the traveler frame. The coal bunker and water tank were also placed there for additional ballast. For some heavy lifts the traveler was anchored to the span. One 3-sheave and one 4-sheave block were used for the topping lift, and two 3-sheave blocks for the hoisting line. All the rigging was of ⅝-in. steel cable. The heaviest pieces handled by the traveler were the 14-ton main post (N.O.-L.O.) and the 11-ton end sections of the chords (*C*, Fig. 1).

Forms Three-Hinged Arch When Closed

The 22-ton rocker sections were unloaded from the cars to the tramway push-car, and then unloaded and erected on the roller castings by jacks. The counterweight truss and cantilever truss to panel No. 3 were then erected, and the whole pulled back and anchored so as to give the end of the leaf an elevation of about 4 ft. when erected. The second leaf was erected at its proper elevation. This plan (*A*, Fig. 1) was adopted so that the end sections of the chords, which telescope to form a three-hinged arch when the bridge is closed, could be erected without cutting them apart or raising the bridge.

The steel of the counterweight truss balanced the main truss as far as panel No. 3, and falsework and forms were then placed for concreting the counterweight (*D*, Fig. 1). Owing to the slab construction of the deck of the concrete arch span on which this falsework was erected, and the use of 8 x 10-in. posts for supporting the counterweight, only 310 cu.yd. (of

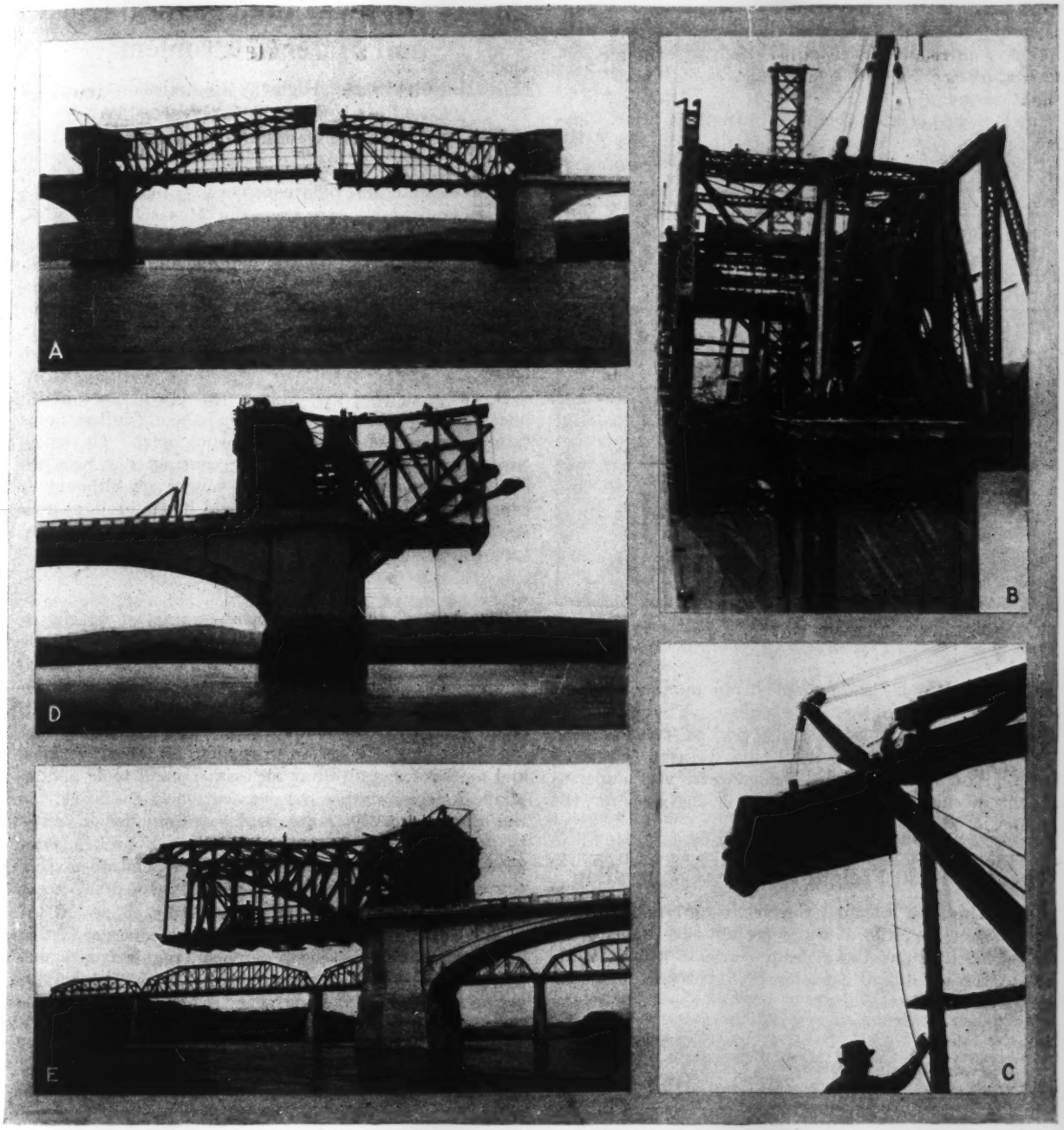


FIG. 1. CANTILEVER ERECTION OF 300-FT. BASCULE BRIDGE OVER THE TENNESSEE RIVER AT CHATTANOOGA, TENN.

A—Leaves were erected at different elevations to avoid interference of chords. B—Traveler at side of bridge floor. C—Traveler placing 11-ton end section of top chord. D—Cantilever erected for three panels; derrick on arch span hoists concrete materials for counterweight. E—Concrete counterweight balancing cantilever and traveler; derrick on top for setting motors and counterweight blocks

the 744-yd. total) was placed at first. Then the erection of the steel span was continued to panel No. 5, the balance of the concrete being poured while the steel was being erected (*E*, Fig. 1).

Sand and gravel for the concrete were delivered on barges, which were moored to the pier directly under the counterweight. The right proportions of sand and gravel were filled into a drop-bottom bucket, which was then hoisted by a stiff-leg derrick (*D*, Fig. 1) and dumped directly into the ½-yd. Smith mixer. The concrete was hoisted in a Lakewood self-dumping bucket in a 90-ft. tower, and spouted to the forms. About 100 yd. of concrete per 10-hour day was placed in this manner.

The concrete was so proportioned as to weigh 140 lb. per cu.ft., to give the required load. An opening was left in the counterweight for placing concrete adjusting blocks, which weighed about 1100 lb. each. These

blocks were made beforehand and stored at the site. The required number were set in place by means of a stiff-leg derrick placed on top of the counterweight for the erection of the motor and removal of the counterweight forms.

One leaf was erected complete in the first place. The pier for the south leaf was not ready until the north leaf had been almost completed, and the same equipment and methods were followed with both leaves. The bridge was completed by July 1, 1917, ready to be turned over to the county board of Hamilton County.

The engineers for the entire work were Greiner, Whitman & Spiker, of Baltimore, Md. The drawspan

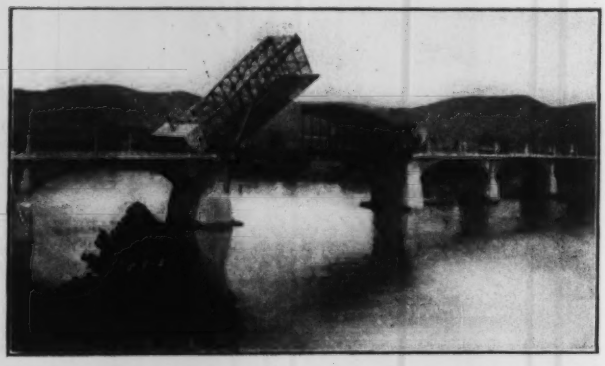


FIG. 2. COMPLETED 300-FT. BASCULE SPAN OF BRIDGE OVER THE TENNESSEE RIVER AT CHATTANOOGA, TENN.

was designed under their supervision by the Scherzer Rolling-Lift Bridge Co., of Chicago. The steel was fabricated by the Toledo Bridge Co., of Toledo, Ohio. The erection was done by the Kelly-Atkinson Construction Co., of Chicago; Gus Schenewerk was superintendent in charge, and the writer is engineer for the erectors.

Create 54,800 Freight Cars by Coöperation

Comparing, for Canada, the years 1907 and 1915, it will be seen that the average freight-car capacity increased 5.8 tons and the average contents 3 tons, while 48% of the additional capacity provided was not used. The general statistics are:

Items	1907	1915	% Increase
Total tons freight carried 1 mile	11,687,711,830	17,661,309,723	51.1
Aggregate capacity of freight cars, in tons	2,908,903	6,731,265	131.4
Total freight cars	105,540	201,690	91.1

The difference in capacity and contents between the average 1907 car and the average 1915 car is represented by the figures: Capacity, 27.6 tons, and contents, 15.4 tons, in 1907; capacity, 33.4 tons, and contents, 18.4 tons, in 1915. Material gains in freight-handling efficiency could be made by increasing the load. An average 1915 load of 18.4 tons, if increased by 5 tons, would be equivalent to placing 54,800 additional cars in service. Shippers should be urged to coöperate with the railroads in their endeavor to increase the existing carrying capacity by using the present available rolling stock to better advantage. Light bulky commodities, of which there are many, should be loaded to the full cubic capacity of cars, while heavier freight should be loaded to the full carrying capacity.

Meets Highway Contractors' Labor and Material Problem

Massachusetts State Highway Commission Introduce Cost-Plus-Unit-Profit Contracts To Remove Gambling Element

MEETING at the outset of the season's work with contractors' bids considerably in excess of the engineers' estimates, the Massachusetts State Highway Commission set about analyzing the situation and finding means to combat the difficulty. As a result, new forms of contract have been developed and are now being tried out. These are the joint product of many conferences of the commission, of which William D. Sohier is chairman and Arthur W. Dean is chief engineer.

It was concluded that bids were high because of the uncertainty of the labor supply and the difficulties in obtaining deliveries of construction material. To remove these gambling elements of the contract has been the object of the State Highway Commission, although in conscientiously working to that end it has brought upon itself and its chief engineer much criticism from certain Boston newspapers.

Terms of Contract

The first of these new contracts was let in May to Michael Serretto, an Italian contractor of Boston, who had previously done satisfactory work for the Highway Commission. By its terms the contractor agrees to construct seven sections of road in the western counties, including grading, surfacing, culverts, guard rails, retaining walls, etc. He agrees to furnish all labor, workmen and mechanics, as well as all teams, small tools and appliances necessary for the prosecution of the work. On the other hand, the State Highway Commission agrees to furnish all materials such as gravel, broken stone, pipe, cement, etc., as well as explosives and all machinery such as power pumps, air compressors, drills, steam shovels, etc.

The other interesting feature of the contract is this: The contractor agrees to furnish regularly itemized statements of the amounts paid by him for labor and teams, and to give the engineer free and constant access to all accounts, bills and vouchers relating thereto. The Highway Commission agrees to weekly or bi-weekly payment to the contractor of the amount of his payroll, which is kept or checked by the Highway Commission's inspector or engineer and sworn to before a notary public by the contractor. The contractor is the actual employer and takes all responsibility under the state and national employers' liability laws. By this particular contract, however, the State Highway Commission pays for insurance under the Workmen's Compensation Act as a part of the labor cost. An 8-hour day is specified in the contract, and the men are allowed to board as they see fit.

The contractor agrees to give his personal attention to the faithful prosecution of the work, and he cannot assign or sublet any part of it without the consent of the commission. He agrees to pay all his bills promptly and to allow the Highway Commission to withhold any sums due him for satisfying legitimate claims against

him. The other conditions as to quality and kind of work are the same as in the regulation contract.

To cover use of small tools, his own time, all overhead expenses and profit, the contractor receives for dry excavation 6c. per cu.yd.; wet, 12c.; all borrow 6c. per cu.yd.; ledge excavation 14c. per cu.yd.; cement stone masonry 50c. per cu.yd.; cement concrete masonry 50c. per cu.yd.; rubble masonry 20c. per cu.yd.; all local broken stone in place, rolled, including all incidental work, 12c. per ton; all broken trap rock, in place, etc., 10c. per ton; all gravel surfacing 8c. per cu.yd.; applying all bituminous material, including all heating, mixing, teaming, distributing, rolling and all incidental work, 0.2c. per gal.; for all 12-in. vitrified pipe in place, including all excavation and other incidental work, 2.5c. per lin.ft.; 18-in. pipe 4c. per lin.ft.; 12-in. cast-iron pipe, 2.5c. per lin.ft.; 18-in. cast-iron pipe, 4c. per lin.ft.; 12-in. corrugated iron pipe, 2c. per lin.ft.; 18-in. corrugated iron pipe, 3c. per lin.ft.; 24-in. corrugated iron pipe, 4c. per lin.ft.; standard guard rail in place, including painting, post preservation and all incidental work, 1.5c. per lin.ft.; rustic guard rail, 1c. per lin.ft.; for all stone filling, 8c. per cubic yard.

The Highway Commission has set maximum limits for the pay of all kinds of labor as follows, but the way is left open to increase these rates should necessity demand, and then the contractor cannot be compelled to continue work unless the increased prices are agreed to by the Highway Commission. The maximum limits are: For laborers, $2.80 per day; double teams and drivers, $6 per day; dynamite men, $3.30 per day; blacksmiths, $25 per week; foreman, $25 per week; and superintendents, $30 per week.

Labor Paid Weekly

So far as possible weekly payment is made by the Highway Commission for labor. Other items are settled monthly. No estimate or payment is made when in judgment of the engineer the work is not proceeding in accordance with the contract, or when the total work done is less than $300 above the previous estimate. The contract empowers the Highway Commission to make more frequent payments if desirable. Final payment must be made 65 days after the final estimate. All prior partial estimates and payments are subject to correction in the final estimate and payment.

The contract further provides that no member of the Highway Commission is responsible for any liability arising from the contract, and that no act of an inspector or engineer can operate as a waiver to any provision of the contract. No changes can be made without action by the Highway Commission.

A Fifty-Fifty Savings-Sharing Contract

A modification of the Serretto contract has been entered into with Daniel O'Connell Sons, contractors, Holyoke, Mass., for surfacing a state highway between Easthampton and Northhampton—a tar penetration job. The conditions which led to this contract were as follows: The work was estimated and bids called for; the three bids received all proved higher than were deemed justifiable. The low bidder was approached as to accepting the work on a cost-plus basis, provided that should the actual cost of the work prove less than the contractor's original low bid the Highway Commission would share with the contractor fifty-fifty on any such saving. But under no circumstances is the total sum to be paid by the Highway Commission to exceed the sum of the contractor's bid.

Commission Furnishes Material

Under this contract the contractor agrees to furnish all labor, tools and equipment, including the heavy machinery. The Highway Commission furnishes all materials and pays the actual cost for the labor and teams as before, the contractor however paying his own employer's liability insurance. No limits are set in this contract for wages. For profit and overhead the contractor receives: For excavation, 7.5c. per cu.yd.; for gravel borrow, 13½c. per cu.yd.; for broken stone in place, rolled, including pea stone and all incidental work, 2.5c. per ton; for applying bituminous material, 1c. per gal.; stone filling, 26c. per cu.yd.; old broken stone excavated, screened and replaced, including all incidental work, 18c. per cu.yd.; all stone removed and relaid, 11½c. per cu.yd.; no allowance is made the contractor on account of the purchase of such tools and appliances as are furnished by him, but for the use of a single drill compressor $2 a day is allowed, and for the use of a steam road roller $8 per day.

Both these contracts and two or three others of similar purport are reported by Mr. Dean to be working out satisfactorily. Where possible every effort is made to let them on such a competitive basis as in the O'Connell case.

How Softened Concrete Lining To Tunnel Will Be Repaired

Plans have been made to repair the concrete lining to the Cascade tunnel of the Great Northern Ry., which, as noted in *Engineering News-Record*, June 21, 1917, p. 579, has softened due to the formation of sulphur compounds formed from sulphur in the locomotive gases and the cement. As the lining was put in principally to protect the rock face against disintegration and not for strength, and as the steam locomotives are now superseded by electric traction, it is thought that repairs made will be permanent.

The proposed method of repair is as follows: (1) Clean the entire area of sidewalls and arch, removing all disintegrated portions. (2) Drilling 2-in. holes where necessary to provide additional drainage. (3) Drill 4-in. holes in the arch where necessary and fill cavities existing back of the concrete lining with sand filling or grouting. (4) Replace all disintegrated portions of the lining with a coating of concrete by a cement gun. The specifications provide that where the coating is over 3 in. deep it shall be supported by a triangular wire mesh—American Steel and Wire Co.'s No. 28 A—cut to fit and fastened to the old concrete by spikes driven into holes drilled in the concrete, 24 in. apart. The mixture for use in the cement gun will be one part portland cement and 3½ parts sand, mixed dry. After cleaning, the surface of the concrete is to be sprayed with an alkaline solution for neutralizing the acid in the concrete. Grant Smith & Co., St. Paul, Minn., have the contract. The plans will be carried out under the supervision of A. H. Hogeland, Chief Engineer of the Great Northern Railway Company.

Making Surveys for Land and Lake Tunnel at Chicago

Triangulation Locates Crib and Rock-Drill Borings on Lake Tunnel—Portable Telephone Used in Survey of Long Drifts—Line Transferred Down Shafts by Means of Two Transits

THE surface and underground surveys for the Wilson Ave. intake tunnel at Chicago were a feature of the engineering work for this long tunnel, which has 3 miles under Lake Michigan and 5 miles under land to a large pumping station. This survey work was described at a meeting of the Western Society of Engineers by H. W. Clausen, engineer of water-works construction. The tunnel was described in the *Engineering Record* Jan. 16 and 23, 1915, and Apr. 29, 1916, and in *Engineering News* Apr. 22, 1915, and May 25, 1916. It is being built by the city by day labor, under the direction of Mr. Clausen.

Triangulation To Locate Borings

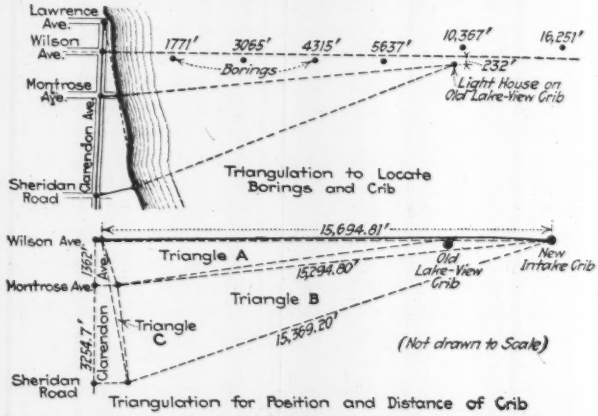
The lake tunnel is placed at such depth as to insure its being in solid rock and thus avoid the troubles of earlier intake tunnels in the shattered rock above. To determine the character of the rock, borings were made by means of core drills, the holes being offset from 40 to 100 ft. from the center line of the tunnel. This was described in *Engineering News* of Mar. 4, 1915.

A preliminary triangulation was made to locate buoys marking the sites for the drill holes and the intake crib. For this a base line 4616.98 ft. long was established on Clarendon Ave., from Wilson Ave. to Sheridan Road, and was tied in to points on the lake front at Montrose Ave. and Sheridan Road. The buoys for borings were set by sighting from the lake-front points at Wilson Ave. and at Sheridan Road to the Lake View crib, and turning the computed angles to the points for borings. This method is shown in the upper view on the accompanying sketch plan. After the buoys were set, platforms for the drills were erected on piles. The buoy for the crib was placed by sighting from the same two points. Four reference buoys were set near it.

Determining Exact Location of Crib

After the crib shell had been placed, a triangulation was made to determine its exact location and distance from the shore shaft. This was slightly different from the first, as some of the original points had been moved. Its layout is shown in the lower plan. With the length of the line in Clarendon Ave. and the lines in Wilson Ave. and Montrose Ave. to the lake shore known, as well as the inclosed angles, the length of a line on the lake front between Wilson and Montrose Aves. was calculated (as the line passed over water). With this calculated line as a base of triangle *A* (on the accompanying diagram), and with the Wilson Ave. crib as the third point, all three angles were measured, and the distance from the shore shaft to the crib was calculated by the law of sines.

Additional triangulations were made to check triangle *A*. With the three lines on Montrose Ave., Clarendon Ave. and Sheridan Road, and the two angles on Clarendon Ave., the line along the shore from Montrose Ave. to Sheridan Road was calculated. This served as the base line for triangle *B*, having the Wilson Ave. crib on its third point. One side of this is common with triangle *A*, and the calculated lengths checked very closely. A third triangle *C* was formed with the three



TRIANGULATION SYSTEMS FOR LAKE SECTION OF WILSON AVENUE WATER TUNNEL AT CHICAGO

points along the shore. From the base lines of triangles *A* and *B* and the angle between them, the base of triangle *C* was calculated. With this base and with the crib as the third point another triangle was formed, having the Wilson Ave. line to the crib as a side common with triangle *A*. A solution of this last triangle checked the common side.

The lake tunnel comprises drift 1, extending 13,882 ft. west from the crib, and drift 2 runs from this point to the shore shaft. The angle between these drifts is 2° 24′ 22″.

A branch will be built from the new tunnel to the present Lake View tunnel, which is at a higher elevation than the new one. This will permit the present Lake View crib and intake (only 2 miles from shore) to be abandoned, both tunnels being served by the new intake 3 miles out. The survey of this branch had to be done very carefully, so as to locate its western end exactly under the old intake shaft. From this end a short shaft will be driven upward and closed at the top with a horizontal steel bulkhead. When the new tunnel is completed, the old intake shaft will be pumped out and extended downward to meet the stub shaft of the tunnel, the bulkhead being then removed. The old intake shaft will then be plugged above the level of the Lake View intake tunnel.

As a check for this survey a diamond-drill boring was made on the tunnel line at a point 103.52 ft. east of the Lake View crib. A buoy for the drill hole was set

on the tunnel line (by sighting from shore) and also in line with two points previously established on the Lake View crib.

A boring platform, on piles, was constructed over this point, and the tripod of the boring machine was set by sighting with a transit on the tunnel line from the shore. The boring was sunk to 118 ft. below water level, or about 6 ft. below the springing line of the tunnel. The hole was 1¾ in. in diameter, and a 1-in. pipe about 18 ft. long was grouted in at the bottom, to be found when the tunnel reached that point.

Break Holes in Walls To Sight Through

After the boring had been completed, the platform was used to make an overhead survey to tie in the underground work with the Lake View crib. The transit was set over the boring and sighted on a plumb-bob suspended over the center of the intake shaft inside of the Lake View crib. To obtain this sight it was necessary to make a hole in the outer wall of the crib and also in the well-room wall. When the transit had been sighted on the bob over the intake shaft, the telescope was turned to the sight on the tunnel line on shore. This was repeated twice. The distance from the boring to the center of the shaft was carefully measured. As the distance of the platform from the crib breakwater was nearly 200 ft., a 200-ft. steel tape was used.

Two points 52.06 ft. apart were set on the Lake View crib platform, on the line of the connecting tunnel. The distances betweeen them and from each point to the boring were measured. The transit was set up over each point in turn, and the angle between the boring and the line on the crib platform was read. With these two angles and the line on the crib platform as a base, the distance from the boring to the point on the connecting tunnel line was calculated and found to check exactly the measured distance. This miniature triangulation was made from the base line 52.06 ft. long, on the crib platform.

Distance from Boring to Shore Shaft

The distance to the boring from the shore shaft was calculated from the base line of triangle *A* of the Wilson Ave. crib triangulation and angles read with the transit set at the ends of the base line. When the tunnel had been excavated to the calculated distance, the pipe left in the boring was found. The actual distance of the boring from the shore shaft was within 4 ft. of the calculated distance. This was considered satisfactory, because the platform and tripod were moved by wind and water during observation, and it was difficult to catch a sight with the transit. The pipe was only 3 in. north of the tunnel line, which was considered to show remarkable accuracy of work.

Methods of Underground Survey

The method of transferring the line down all the shafts comprised the use of two ordinary transits reading to 20 sec., and two plumbing wires (No. 1 piano wire) from 6 to 10 ft. apart, each carrying a plumb-bob weighing about 10 lb. The transitman on top kept these wires carefully on the tunnel line by continual observation. The pumps, cage and all other work about the shaft was stopped. The engineer below adjusted the plumb-bobs so as to allow them to hang freely in pails of oil. The oil was sufficiently thick to prevent the bobs from swinging widely, and they came to rest more quickly than in water. The crew on top would signal by tapping on a pipe when the wires were on line.

The crew below had the transit set in the drift back of the one to be lined, and about 50 ft. from the wires. On receiving the signal, and when the bobs had come to rest, the observer would shift the transit to line with the wires. He would then set a point in the roof of the tunnel close to the shaft and at least one more point nearer the face of the drift.

All the shafts were plumbed three or more times while the first 2000 ft. of tunnel was being excavated, and about once for each 2000 ft. beyond. The latter plumbings check the stability of the points previously set and also the accuracy of those carried to the face of the drift from the original points. The line points are spuds driven into wooden plugs set in 2-in. holes drilled 6 in. in the roof. A horseshoe nail with a small hole drilled for the eye is used for a spud.

Platforms in Drifts for Transit Work

In some of the drifts, platforms were used for transit work. These were built high enough to allow trains and men to pass freely underneath. In this way the instrument work was carried on without interfering with the tunnel work. A trivet (instead of a tripod) was used on the platforms. The transit was set up under the point in the roof, from which a plumb-bob was suspended. Grades were carried forward from plugs set in the side of the drift. For entering the face of the drift for drilling, the line was usually sighted in by the plummet lamps. Sometimes the grade was carried into the face by the use of plummet lamps, and at other times by a straight-edge about 10 ft. long. Hand levels were found unsatisfactory.

Three of the shafts being on the line of the tunnel, the surface line was transferred directly to the drift. Two other shafts were located away from the tunnel line, to which they were connected by stub drifts. At these it was necessary to turn an angle (the same as on the surface) between the shafts and tunnel line. This angle was checked by repeating the plumbing operations.

Telephone Assists Tunnel Survey

In the long drift under the lake (drift 2) from the shore shaft, a novel method of telephone aid was used to speed up the work of checking the line from the shaft to the heading. Three "sight boxes" were used for foresights, and no backsights were taken. Each box contained two clusters of two 60-watt tungsten lamps, connected to a piece of extension wire plugged into a socket on the lighting wires along the wall. A plumb-bob was suspended from the line point in the roof between the clusters, and sighting was done on this bob. The first box was set about 1400 ft. from the shaft. After setting the first sight box, the rodman went forward about 1000 ft. to the next point and awaited the observer's signal to place the second box.

The observer and the rodman each carried a telephone hand set, these being connected to the tunnel telephone wires by scraping the insulation from the latter. The observer would sight on the first box and when he had the vertical hair on the plumb-bob he would hammer

on the power air-pipe. The rodman would answer on the telephone, and would then be directed on the telephone to place the second sight box and bob.

When this plumb-bob was carefully set on the line with the first sight, the rodman would take his telephone and the third sight box to the next point, about 1000 ft. beyond. The rodman's helper would return to the first sight box and remove it for the observer to set the transit at that point. The helper would remain and aid the observer in setting up the instrument, then take the sight box forward to the rodman. The instrumentman would foresight on the second box and, as before, sight forward to the rodman and set that point. This operation was repeated until the line was checked into the heading.

By this use of the telephone much longer sights were used and also much walking backward and forward to receive instructions was eliminated. Only the helper was compelled to double back on the trip, and the entire drift (now 13,000 ft. long) was checked in one day.

Survey Work for the Land Tunnel

The land tunnel is located under Wilson Ave., but although this street is practically straight, it has several offsets and a few very small angles, while its width varies from 80 to 66 ft. The 12-ft. tunnel section called for 13 ft. 4 in. excavated width, and it was desired to pass under the offsets in the street without sharp curves and short tangents. A preliminary survey determined the possibility of driving this tunnel within the street lines. Measurements were taken with ¼-in. steel tapes, and corrections made for temperature. Permanent points were set on the triangulation surveys and also on the preliminary and location lines. These points were either copper plugs or iron bolts.

There is a shaft at the shore end of Wilson Ave. and another at the Mayfair pumping station, with two intermediate shafts. The distances between the shafts are from 1½ to 1⅞ miles. Drift 3 runs west from the shore shaft; two drifts extend from each of the intermediate shafts, and drift 8 extends east from the Mayfair shaft. Connections have been made between drifts 3 and 4 (within 1.2 ft.), and between drifts 7 and 8 (within 0.2 ft.).

Triangulation was necessary to locate the line of drifts 7 and 8, as these could not be run on the surface. Sights were taken from the construction trestle at the Mayfair shaft to the headhouse of the next working shaft (Lawndale Ave.) and to the Mayfair gate shaft. A sight was also taken from the Lawndale shaft to the gate shaft. The distance from the trestle to the gate shaft was measured. The third side of this triangle was the tunnel line, as determined previously by a traverse from the Mayfair shaft to the Lawndale shaft. This traversed line checked closely.

Use Broken Sandstone in Concrete Pavement

Several sections of concrete pavement were laid in Duluth, Minn., late last fall as an experiment, using Kettle River sandstone as the coarse aggregate. Lyonel Ayres, city engineer, writes that the pavement has come through the winter satisfactorily, only two small hair cracks appearing on the surface. There was no travel on the pavement before winter set in.

Society Service

A Section Dealing with the Results of Teamwork by Technical Men

Good Work in St. Paul

For some time engineers have been looking to Minnesota to learn of the results of the coöperation practiced there between the various societies. The Civil Engineers' Society of St. Paul, one of the organizations in the affiliation, has recently paid the expenses of a delegate to the National City Planning Conference at Kansas City, who made a formal report and with it a recommendation to the mayor to appoint a planning commission of local men. Quite a few members of the local society have been appointed to important committees of the Association of Commerce.

Publicity is obtained through the *Bulletin*, issued jointly with the Minnesota Surveyors' and Engineers' Society. One of the staff of this monthly magazine gets notices of the society affairs into the local papers. These items are intended to show the community what is being done to advance the interests of the profession. The governor has been induced through the society to put an engineer on the State Board of Health. Employment is handled in the *Bulletin*.

Brooklyn Works at Coöperation

The Brooklyn Engineers' Club gets out annually a 4½ x 7-in. pamphlet giving its organization, aims and appeal. The one for 1917 contains attractive views of the clubhouse, a brief outline of the organization and information as to meetings, the fine library maintained, entertainments anticipated, excursions planned and advantages of membership. Grown up since 1896 under the wing of the national societies in Manhattan, it aims to supplement them rather than interfere with their activities. It combines with its broad technical programs and social activities features which are not available either in the national society or in any social club. The club endeavors to help the younger members to improve their technical and financial condition.

Brooklyn Works at Co-operation

Results have been secured in Rhode Island, where practically all the resident members of the national engineering societies, together with twice as many more not so affiliated, are associated in the Providence Engineering Society, a membership of over 500. The general meetings of the past year have had an average attendance of 275 and the section meetings, of which there were 37, an attendance of 45. Local topics discussed at these meetings have aroused a great deal of public interest.

The society has been instrumental in securing important state legislation, has taken an active part in public safety work, has made an engineering census of Rhode Island, and is helping the advancement of technical education in the public schools. This means that the engineers of Rhode Island are getting acquainted with each other and have the inspiration of working in a common cause.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Should Concrete Pavements Have a Prepared Sub-Base?

Sir—I was much interested in your editorial comment on p. 515 of the issue of June 7, on the results of the investigation conducted by the Universal Portland Cement Co. as to the use of sub-base with concrete surfaces. This is a subject to which I have given considerable study during the past six years, and it is rather surprising how little satisfactory data can be secured relating thereto, when you consider the large amount of money involved.

Excavation for pavements in Duluth will possibly average about 80c. per cu.yd., while material for a sub-base may cost approximately $1.60 per cu.yd. Thus, for a sub-base 6 in. in depth the cost will be abount 40c. per sq.yd., or an additional cost of approximately 22% over that of a first-class concrete pavement. It would seem that before any such expenditure as this would be justified, there should be some very well defined function that the sub-base should perform in connection with the pavement.

So far as I have been able to ascertain the main purpose of the sub-base is to effect drainage and thus eliminate the swelling of heavy clay soils due to severe frost action. I inclose two photographs that were taken of a concrete pavement in the early spring. This pavement has a 6-in. cinder sub-base and is of the granitoid

FROST HEAVES CONCRETE PAVEMENT

type, with a longitudinal expansion joint down the center and cross-expansion joints every 25 ft. You will notice from the first picture how the upper slab has lifted above the other, while in the second picture it shows the pavement lifted at the center so that the fingers could be inserted with ease in the longitudinal joint. This is one case of several where excessive displacement of pavements has occurred, where a sub-base has been provided. In some cases this vertical displacement has exceeded 6 in. This could hardly be due entirely to swelling clay, for the rise is equal to that of a body of water 6 ft. in depth frozen solid for its entire thickness.

If the pavement be examined carefully one will find that this displacement is due to water freezing in successive layers, and that this condition has been aggravated by the porous sub-base allowing the water to

WATER FREEZING IN SUCCESSIVE LAYERS CAN EXPLAIN APPEARANCE OF THIS CREEK

spread out readily over a considerable area. Under no circumstances could a sub-base be expected to remove water other than that which might accumulate between the clay subsoil and the concrete, and, therefore, to be effective it must be carried to such depth that contained water would be safe against accumulative freezing, which, of course, is never done. While I am thoroughly convinced that this sub-base as a drainage feature, in cold climates at least, is not only worthless but is actually a detriment, I am not so sure, however, but that there are conditions under which it does add something of value.

The reason I think cinder or slag are preferable to sand or gravel when a sub-base is used is that the thermal conductivity of the former materials is very much lower than that of the latter. The correctness of this theory is substantiated by the better conditions of sidewalks that are laid on cinder than those laid on sand; better protection seems to be provided against frost penetrating the clay subsoil, and the intensity of freezing is thus reduced.

Another function possibly performed by the sub-base is the decrease in friction between the concrete slab and the subsoil; this could only be in times of cold weather, as the coefficient of friction between concrete and moist clay is less than that between concrete and materials used in the construction of a sub-base. However, even then one can conceive of conditions where high frictional resistance is even desirable, as it may serve somewhat in the nature of reinforcement and thus strengthen the slab.

Of course, every one will admit that a sub-base will increase the bearing power of a very wet subsoil; how-

ever, in most cases tile properly laid will accomplish the same result at a less cost.

Taking the matter as a whole, it seems to me that conditions are very unusual where an engineer can justify the expense incident to the construction of a sub-base, and much of the disagreement among engineers and those having to do with pavement construction is due to lack of strictly scientific data relating to the underlying principles. There is room for much research as to the behavior of clay under various conditions of temperature and varying amounts of contained moisture.

And it would seem that the science of paving is a matter which the physicist could very profitably give some attention to, and with the aid of his delicate instruments determine within more reasonable limits the complicated workings of the natural laws with which the paving engineer is confronted.

JOHN WILSON,
Civil Engineer.

Duluth, Minn.

Bituminous Foundations for Sheet-Asphalt Surfaces

Sir—It seems to me that Lester Kirschbraun's paper, "Bituminous Foundations for Sheet Asphalt Surfaces," on p. 591, issue of June 21, is indeed timely, in view of present-day motor-truck traffic, and in view of the increasing tendency toward cracks in asphaltic surfaces, particularly asphaltic concrete. Under closer inspection we are getting better concrete foundations, and yet the result is that the frequency of cracks on surface and base is constantly increasing.

Perhaps engineers, at least many of us, and contractors almost one and all, have gone along laying portland-cement concrete foundations and taking it for granted that they have a pavement which will stand most any test. But such a base is not standing every test. In our 45 miles of asphaltic pavement (35 miles of which are asphaltic concrete) the cracking feature has started us to studying with reference to what kind of a pavement we can lay that will not crack.

Mr. Kirschbraun and the writer have had many talks on this subject and have come to the conclusion that something must be done in Oak Park, at least, and we will do some experimenting along the lines alluded to in Mr. Kirschbraun's paper, as soon as the opportunity presents itself.

May we ask where are the contractors on discussions of this nature? Contractors should be vitally interested in developments and improvements in pavements, yet almost every improvement that has been made was conceived by an engineer. Paving is the contractor's business, not the engineer's particularly. Why should he not come forward with at least his ideas now and then?

H. W. SKIDMORE,
Construction Engineer,
Department of Public Works.

Oak Park, Ill.

Manufacturers and Technical Societies

Sir—An editorial on page 1 of the July 5th issue of *Engineering News-Record* touches briefly—too briefly—upon a most vital and important relation between the American manufacturer and such of the leading technical societies as the American Society for Testing Materials. The statement is made that ". . . the meetings are attended by the manufacturers to such a point that sometimes the original character of the society is lost." If such be the case, and no doubt it is, value might come from speaking frankly of the causes and the probable ultimate drift of our leading engineering societies.

In the first place, the engineer himself is finding an ever-increasing value for his services among the commercial interests of the country. The younger men of the profession are finding far greater opportunities by taking root in the fertile soil of the quickly growing industries of America. Now, when men who are trained as engineers take hold of the producing interest of any commodity there invariably results fundamental changes looking toward improvement, standardization and economy. It has been observed that at least these men attempt to pin the badge of honesty and frankness to their own commodity as well as to their own character. It is due them that full credit be given for such honesty and frankness. Few will deny that men who have studied their business in detail from a commercial, laboratory or consuming point of view are a valuable asset to any technical society whose chief aim it is to create a closer and better understanding between these three branches of modern industry.

The second cause for the dynamic aspect of our technical societies with relation to membership is to be ascribed to a new realization on the part of the manufacturers themselves, who have found that it pays to be honest and fair as well as "open for inspection." The editorial in question states that "it remains for the consumer to continue to be alert in the consideration of reports in order to preserve the proper balance on which the whole life of the society depends." Such is unquestionably a true statement of the case. It is a well-recognized human attribute for one to be over-enthusiastic for the particular commodity in which he has become most interested. On the other hand, the engineer interested primarily on the consuming side of the fence owes not alone to himself an active and virile interest in the affairs of technical societies, but likewise owes his best support to all the general administrative affairs of the society so that a balance will be maintained guaranteeing that continuity of healthy development for American industry which in time is sure to extend and permeate the commercial relations of the entire world.

The American engineering societies should therefore welcome the producer as well as the consumer and effect a balance of influence from these two sources, at the same time giving equal credit for honesty and fairness.

HARRY Y. CARSON,
Central Foundry Co.

New York City.

American Society for Testing Materials

Sir—Referring to the news account of the twentieth annual meeting of the American Society for Testing Materials on pp. 11-13 of the issue of July 5, I would take the liberty of calling attention to several slight errors. On p. 12, first column, the sentence beginning with line 5 should read, "The committee's recommended specifications were all accepted as tentative." That is, all of its specifications and revisions were recommended

as tentative, and, therefore, are not subject to letter ballot of the society.

The same remark applies to the sentence beginning at the bottom of p. 12, the two specifications there referred to being submitted as tentative. On p. 12, second column, the phrase "with the addition to the title of the words 'all other preservative oils,'" should be omitted. The motion to add these words to the title was made at the last session of the annual meeting, but was lost; and the specification was referred to letter ballot for adoption as standard, as printed in the report of the committee.

Referring now to p. 11, "Some Items of General Society Interest," permit me to correct what appears to be a wrong impression, as I read the second sentence under that heading. The action taken at the meeting with reference to the publication of tentative standards is to apply not only during the odd years (when the book of standards is not published), but also in the even years. Since tentative standards may be submitted in the even years, as well as the odd years, and since they are not printed in the book of standards, the need for a separate volume for tentative standards exists in the even years also.

Will you mind if I also call attention to several typographical errors which I believe you would wish to know about if they have not already been noticed?

On p. 2, the reference should be to Prof. Henry M. Howe instead of to Prof. M. A. Howe. On p. 11, second column, sixth line from the bottom, Committee D-10 should read Committee D-1. On p. 12, first column, the reference to "Committee A-3 on Wrought Iron" should be to Committee A-2. On p. 12, second column, in line 9, the word "calorimetric" should read "colorimetric." On p. 12, the reference to Mr. B. J. McAdam, Jr., should be Mr. D. J. McAdam, Jr.

C. L. WARWICK,
Assistant to the Secretary,
American Society for Testing Materials.
Philadelphia, Penn.

Use More Models in Engineering Schools

Sir—There has been a great deal of publicity given to methods of instruction in engineering colleges the past year, but as far as I have noticed there has been little published on the use of models in class work. This is a matter that deserves more attention.

The average student in college has had opportunity to see very few plants in actual operation. He is shown pictures, lantern slides, plans and sections, etc., and listens to many lectures on different phases. He reads about construction and operation in the textbooks and engineering journals, but he does not grasp the correct proportions of the various parts of structures as he should. This is not the fault of the instructor, nor is it due to the backwardness of the student. It is due simply to the fact that there has never been impressed upon his mind a picture of the different parts of the plant in their relation to each other.

The university which I attended, as a sort of "grand finale" to the civil engineering course, near the end of the senior year allowed the members of the class to take a three-day "inspection" trip to Chicago. As I look back, I think without a doubt that I learned more in those three days than I did in any one month of my schooling. There stands out the fact also that many conceptions which I had formed during the four years of the course were suddenly proved entirely wrong, and many hours of faithful study rendered useless simply because I had not previously had the opportunity of seeing what I was studying.

While, of course, it is out of the question, from a standpoint both of time and finances, to take many trips to plants in actual operation, especially when the school is far from any large center of industry, yet it is possible to bring to the student a model built to scale. I well remember in the corridor of our Engineering Hall, a model of a simple span bridge. It was made by someone in the university, and that someone will probably never know how it helped me to understand more fully the different parts of a truss.

In the American Museum of Natural History in New York is a room devoted to sanitation and water-supply. It contains a great many models of water-purification plants and sewage-disposal plants, and an afternoon spent in that room has proved as good to me as a week of study in textbooks.

As to the cost of such an exhibit I have not the slightest idea, but, unless it is prohibitive, I surely think that it would be the best investment any engineering school could make.

CHARLES M. BELL.
Woodcliff, N. J.

Should Public Improvements Stop?

Sir—I wish to take exception to your attitude regarding public improvements. It is admitted that the cost of construction work is at least double what it would be in normal times, owing to the scarcity of labor and the great demand for materials. In the case of public work this means that the tax or issue of bonds must be doubled; in other words, the taxpayer will be called upon to pay an unusual amount at a time when he is taxed to the limit to preserve his country. At least 3,000,000 of the more efficient alien workmen have been taken from the country for foreign armies. The nonalien is needed in the workshop and on the farm, and the money is needed for war expenses. For these reasons, it would seem that to advocate any public work but that of the most immediate necessity is unpatriotic, unprofessional and unbusinesslike.

W. H. RICHARDS,
New London, Conn. Consulting Engineer.

[The difference of opinion between the editorial expressions of this journal and the view held by Mr. Richards appears to be in regard to what work is of immediate necessity. If the country is to stop developing, if its public works are to be shut down, and if no business is to be continued except that immediately concerned with equipping and provisioning an army, the financial and economic setback to the entire nation will not be measured in terms of a few million or few hundred million dollars—it will be measured in terms of a national calamity. One can conceive that this country might be so close pressed by enemies that such a condition would actually be brought about. The calamity would then be inevitable, everyone would have to make the best of it. To take any action at present, however, which would even partially produce such a result, would be highly unpatriotic.

The factors to be balanced in considering whether work contemplated should be carried out are, on the one hand, the increased first cost due to inflated values prevailing in the present market, and on the other hand ultimate operating economy for the city or the country. For example, should a city at the present time by extending its utilities have the opportunity of inducing manufacturing establishments to locate within its boundaries, which would double its population, increase its property values and establish it on a more prosperous basis for years to come, the wise city engineer would not consider the present increased cost of construction materials in advocating the immediate execution of the necessary work. In other words, it is not the first cost, but the first cost considered in connection with the ultimate returns, which must govern.

It is unfortunate that Mr. Richards should make one or two evidently off-hand statements which cannot be passed without correction. It is not admitted that the cost of construction work is at least double what it would be in normal times, and an analysis of prices of labor and materials in connection with the cost of real estate and other expenses connected with every project will show, this journal believes, that the cost of construction has not increased by any such percentage. In the next place, so far from 3,000,000 of the more efficient alien workmen having left the country for foreign armies, the total number of aliens of both sexes and all ages leaving this country since January, 1914, is less than 536,000, while in that period immigration has reached a total of 1,382,000, departures exceeding arrivals only in one month of 1914 and two months of 1915.—EDITOR.]

Relations Between Engineer and Contractor

Sir—Our technical papers have given us very little advice on the human element entering into the relations between engineers and contractors. We have many technical discussions on strength of materials, structural design, equipment, organization, contract forms, the law, shortage and inefficiency of labor and many other related subjects; but what of the very necessary and ever present points of contact between those in charge of construction for the owners as engineers, and those in charge of construction as contractors? Are such matters pertinent to technical journals, or are they to be left in the domain of metaphysics and psychology?

What are some of these points of contact and what are the human relations between these two classes? Or is there only one class? Are we, as engineers, treating contractors fairly and squarely in all of our dealings with them? Are we writing our contracts and specifications clearly, concisely and completely? Are all doubtful features eliminated or drawn to the attention of the contractor? Do we call in competent contractors and ask their opinions as man to man, and equal to equal when we draw up plans and specifications for a complicated or unusual design? Do we write into specifications that certain items are to be done "to the satisfaction of the engineer," knowing full well that neither we, nor any of our assistants, have any idea of what that "satisfaction" will result in? Do we prepare our original estimates properly and completely, so that the actual cost figures do not over-run appropriations, and we do not have to cut some poor devil on his classification? Do we draw up our transportation clause on railroad work so that all work-train service is paid for by the contractor and then leave him to the tender mercies of the division officials, who are trying to make a record and who believe that all contractors are rich anyway? Do we really and truly take our contractors into our confidence? Do we mobilize all of their resources, mental as well as material?

What folly not to use to the limit the clearly bought knowledge and experience that some contractors continually and freely offer us. Many ghastly failures and costly experiments, many wranglings and lawsuits can be avoided by consulting an experienced and reliable contractor, both before the work is started and during its progress. Plans and specifications are not too sacred to be modified as conditions warrant, and the contractor's plain rights should be fought for by the engineer where the interests of other departments are involved. Better prices will be obtained and work will run more smoothly if close and cordial relations exist between contractor and engineer.

Of two large railroad systems operating on the same territory, one was fortunate in having an engineering department with a reputation for close figuring, but of absolute frankness and fairness to big and little contractors; the other road's engineering department had a reputation for doing small things—in other words, meanness. The work on the first road was always done quicker and cheaper than that on the second road.

It is commonly known among contractors that bids going to certain engineers have a percentage added to cover the unknown factor of the personal equation of that engineer. Would not more study of these relations pay us?

FRANK B. WALKER,
Assistant Engineer, Bay State Street Railway Co.
Boston, Mass.

West Genesee Street Bascule

Sir—I wish to call attention to a few errors made in adapting my article on the West Genesee St. bascule bridge for publication in *Engineering News-Record* of June 28.

Fig. 1, on p. 634, is not the West Genesee St. bridge, Syracuse, but another bridge, as is apparent from the arrangement of the lateral system and the absence of skew.

Referring to a statement in the title and the first paragraph, I would like to say that the use of a fixed floor over the counterweight pit does not depend upon the skew of the bridge. On the contrary, in a skew bridge the fixed floor, adopted for other reasons, introduces difficulties which are overcome by the special features of design illustrated in the article.

The third paragraph of the printed article states that because the girders descend through openings in the pit floor, a heel-lock may be omitted; whereas the heel-lock is omitted because the pit floor is stationary and the live-load back of the trunnions are not carried by the moving structure.

ARTHUR G. HAYDEN,
Bridge Designer, Barge Canal Office.
Albany, N. Y.

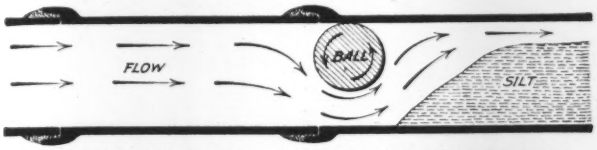
THE ENGINEER IN FIELD AND OFFICE

A DEPARTMENT DEVOTED TO DETAILS OF THE DAY'S WORK

Zinc Balls Clean Sewers

By J. C. Keeley
Assistant Engineer, Engineering Department, Owensboro, Ky.

SOME years ago a pipe sewer system was constructed under the supervision of E. B. Shifley, city engineer, Owensboro, Ky. It was stipulated in the specifications that a ball 2 in. smaller than the bore of the pipe should pass through without lodging. In making this test on a certain section of sewer, the ball became lodged and had to be flushed to the manhole below. When the ball appeared in the manhole, it was found carrying a half brick before it. Appreciating the



HOW THE BALL AND WATER CLEAN THE SEWER

significance of this accidental discovery, Mr. Shifley applied this principle to the cleaning of sewers. The writer for a number of years has used this method with excellent results. It is not successful where roots are encountered, but where silt and débris have collected in the sewer—due to the absence of flush tanks and catchbasins, or where the latter have been allowed to fill—this plan has been found to be cheaper than the drag or bucket method and entirely satisfactory.

When a sewer is flushed without a ball ahead of the stream of water, the sand or silt is pushed forward by the flow of water and the outlet is choked, thereby

ALL THIS DIRT REMOVED FROM SEWER BY FLUSHING BALLS AND ACCESSORIES SHOWN

causing the water to back up and so lose its nozzle pressure; when a ball is used ahead of the water, the outlet is kept partly open, thus utilizing the pressure.

If the sewer is badly choked, a ball 5 to 10 in. smaller than the diameter of the pipe is placed in the sewer at the manhole and a stream of water applied behind the ball until it appears at the manhole below; the deposit is removed from the manhole, and a larger ball is then started from the manhole above and carried through as before. This plan is repeated until the sewer is clean. To insure a clean sewer, the last ball to pass through should be 2 in. smaller than the sewer. Where sewers are not badly choked, the first ball may be large, the size depending on the condition of the sewer. The ball should float and should be as light as is consistent with strength. Those used with best results are hollow and made of two thicknesses of No. 24 gage zinc, the seams being set at right angles. The sizes run from 4 to 22 in. Wooden balls have not proved satisfactory.

A fork or screen with a sandbag directly in front of it should be placed at the inlet end of the lower manhole. This is to prevent the ball, together with the silt expelled from the cleaned sewer, from escaping into the next section of sewer. A line of sewer should of course be cleaned in sections, beginning at the upper manhole.

Last year an abandoned sewer of 15-in. diameter was found to be almost filled with silt, there being a space of about 2 in. only at the top to allow passage of water. In cleaning this the writer first used a 4-in. ball, and last a 13-in. ball. With the aid of these balls, 5 cu.yd. of sand was removed from this sewer in four hours.

The accompanying sketch shows the position of the ball and its action. The view shows the material removed from a section of sewer and the balls and tools used in doing the work.

Well-Constructed Farm Entrance Drains Are an Economic Necessity

By Donald A. Thomas
Michigan State Highway Department

IN BUILDING culverts to connect roadside ditches at farm entrances, care should be taken that they are of adequate size, of such strength that they will not become broken and so tight that they will not leak. The

PERMANENCY OF CULVERT INSURED BY PROPER END WALLS CARRIED BELOW FROST LINE

Form 016 6-16 5M

DATA FOR ORDER No. 58645

(Estimate No. 34756)

Description Clarendon Hotel.
Location Great Falls, Mont.
Contractor John Smith & Co.
Owner Clarendon Hotel Co.
Ship to John Smith & Co.
Great Falls, Mont.
Ship via G. N. Ry.
Date of Order Feb. 1, 1916 To be completed 1st.Fl.3-16. 2nd Fl.4-10. Balance 5-20

Material to be ordered None | List for cutting Yes
Material from stock Yes | Cut Stock and Report Yes

Painting 1-Coat red lead
To be erected by Contractor
Above data furnished by W.R.Z.
Additional data: Drawings to go directly to Architect for approval

Steel Shop	753,000 #
Foundry	14,000 #
Blacksmith Shop	
Machine Shop	
Mcs.	

DRAFTING DEPARTMENT.

Order Rec'd FEB 3 1916 Filed 6/24/16
Order Compl. 6/24/16 Draftsman RAS
Lg Draw. No. A-1 to 18 Set Shts. No. —
Bills No. 1 to 10 Plans RAS 16 C 442
Ship. Lists No. 1 to 24
Remarks Approved dgs 18

FIG. 1

Order No. 58645 Structure Clarendon Hotel Est. No. 34756
Architect Thomas Jones Order Rec'd 2/1/16 Filed 6/24/16
Contractor John Smith & Co Draw. Rec'd 2/5/16 Filed 6/24/16
Location Great Falls, Mont Draw. App'd 2/19 Ret'd 3/16
Erector Contr Draw. App'd 3/9 Ret'd 3/16
Delivery 3/16. 4/10. 5/20 Plans Rec'd to Contr 6/24
Tonnage 376 Det. Held Dup. 2 cpy 3/16
Checker RAS Det. Ret'd " 2 - 4/3
Draftsman D.S T.G Total Cost 300.00 P/T 80%
Struct. Shop 3/1. 3/15. 3/17 Time RAS 3. B.16 C.132
Stairs & Fire Esc Shop Time
Omal Shop Time
Mscl Shop Time
Remarks Dups to Archt for approval COMPLETE.

FIG. 3

DRAUGHTING DEPARTMENT

Order No. 58645 St. Paul, Minn., Feb. 20, 1916

To Thomas Jones, Archt.,

At Statler Bldg., St. Paul, Minn.

The { copies under separate cover } of our { shipping lists / set sheets / drawings A-1-2-3. }

1st.Fl.Beams Basmt.Cols. for Clarendon Hotel-Great Falls - are sent for your convenience and information. In case of any errors or omissions, please notify us at once.

NOTICE
We cannot be responsible for deferred shipments when delayed in receiving measurements or approval of our shop details.

Yours truly,
E. A. Goetz
CHIEF ENGINEER

Remarks: Please approve and oblige.
Check figures noted on drawing No. 2.

SM 9-16 C&H

FIG. 4

CONTRACTOR John Smith & Co.

Order No.	Structure
58645	Clarendon Hotel. Great Falls, Mont.

LOCATION Great Falls, Mont.

Order No.	Structure
58645	Clarendon Hotel. John Smith & Co.

STRUCTURE Clarendon Hotel

Order No.	Description
58645	Great Falls, Mont. John Smith & Co.

Order No. 58645 FEB 3 1916 Est. No. 34756
Name Clarendon Hotel. Great Falls, Mont.
Gen'l Cont. John Smith & Co.
Designer Architect. Erector Contractor
Data Order clerks data
L. Drawings A-1 to 18
S. Drawings None
Ship Lists 1 to 24
Blue Prints Bal. to Contr
R.A.S. D.S. T.G.
Drawings Filed
Sets Filed None
Data Filed With S.Lts.

FIG. 2

ORDER NO. 58645 Date 3/1/16 191

SHEET NO. DRAWING	SHEET NO. SET	SHEET NO. SHIPPING LISTS	SHEET NO. BILLS	No. Prints	SENT TO	REC'T
				1	Asst. Supt.	
1-2-3			1 to 4	1	Template	
1-2-3			1 to 4	1	Structural	
				1	Painters	
				1	Blacksmith	
				1	Machine	
		1-2		1	Bill Clerk	
		1-2		1	Cost Clerk	
		1-2		1	Ship'g Clerk	
				1	Storekeeper	

ORDERED BY RAS PRINTS SENT I
PRINTS TO SHOP B/G DATE 3/1
NOTE - Shop Foreman Must Sign This Receipt.

FIG. 5

REQUISITION

For drawings, etc., from Drafting Room files for use by other departments or other parties.

Order No. ..... Date .....
Data Sheet (with shipping lists, etc.) .....
Plans .....
Drawing .....
Set Sheets .....
Shipping Lists .....
Sign .....

SM 7-16 C&H

FIG. 6

DEFERRED SHIPMENTS

ORDER NO. | ORIG. SHIP. | BY
CONTRACTOR | DATE

MATERIAL	KIND	DRGS. O. L.	SHOP	SHIP

REASON FOR DELAY:

FIG. 7

THESE FORMS FACILITATE WORK OF STRUCTURAL STEEL DRAFTING ROOM

ds of the culvert should be protected by a head wall rried down below the frost line to a firm foundation. this is done, it will protect the ends of the culvert rom being broken, frost will not displace it, the surrounding earth will not slide down in front of the opening, and with the further necessary work of keeping the ditches clear, the culvert will be able to care for all the water alongside the road.

The prevalence in many localities of inadequate culverts improperly protected and too small in size is due to the absence of a settled policy and to an underestimation of the importance of these structures. In most cases the installation of a culvert is left to the property owner—perhaps in some cases under the supervision of the authorities—but unless care is taken, the completed job is lacking in many details that would tend to provide a suitable means of carrying off the water which inevitably accumulates in side ditches during storms. Even when precautions are taken to lay the culvert properly, it is very infrequent that the necessary consideration of permanency is sufficiently weighed.

The accompanying illustration of a farm entrance on a Calhoun County, Michigan, road, is interesting in this connection. It is an example of the substantial type of work that the Michigan State Highway Department is contending for on all state-reward roads.

Definite Procedure Simplifies Drafting-Room Work

By E. A. Goetz
St. Paul, Minn.

IN PREPARING structural-steel and iron shop details, the object to be attained is to secure legible and accurate drawings at the lowest cost per ton and at a stated time. To control the work of a drafting room to meet the above conditions, a definite and efficient method of procedure is necessary.

The writer has conducted a drafting room for some years on a regular basis of procedure with respect to each order. The order is received on a data sheet, Fig. 1, together with plans, specifications, etc., from the order clerk, and is recorded by the drafting-room clerk on four cards of the general drafting-room files, Fig. 2. The data and information then pass to the chief for examination. He records the order on a card of his private file, Fig. 3. As will be noticed, this card is useful as a daily follow-up and indicates very nearly the status of an order at a glance. The reverse side is used for special items. The "complete" stamp is affixed by the chief when the order is completed and filed.

The chief now assigns the order to a checker or squad boss who is a specialist, more or less, in the particular line of work, such as railroad buildings, factory buildings, tank and plate work, ornamental ironwork, fire escapes, railings or the like. This classification should not be carried too far with all men, as it will aid the work of the office to carry men who are experienced in more than one line, especially when the force is decreased.

The chief draftsman should make it a point to review his cards each morning, consult the checkers and prepare a schedule, as far as possible, of orders on which drawings are to go to the shop or for approval that day, and of orders on which there will be correspondence, drawings to contractor, etc. Letter writing is decreased considerably by the use of the form, Fig. 4, when drawings are sent for approval, measurements or for the contractor's use. When results are slow to follow, delay is lessened by using the stamp at the lower left-hand corner. Trouble is avoided in the field by sending the contractor details as well as erection plans.

Fig. 5 shows a record of all prints sent to the shops and the time they were delivered. "Prints to shop" is a signal by the chief to the blueprinter as to the urgency of getting the drawings to the shop.

Timekeeping System

The drafting-room clerk records the time spent on each order by each man daily. This record is given to the chief when the order is filed, and there is therefore maintained on the chief's card a record of costs, and incidentally of the draftsmen's efficiency. This cost record is used by the estimating department in some cases and includes the general overhead of the drafting department. When an order is complete, the drafting-room clerk files all data and drawings in the drafting-room vault and completes the record on the data-sheet stamp, lower right-hand corner.

When any department wishes to use drawings on file in the drafting room, the recipient must sign for the drawings requisitioned on the form for that purpose, Fig. 6.

As will be noticed in Fig. 1, a certain time of delivery is scheduled (or of completion of the order). When, however, a delay arises in the drafting room due to lack of information, measurements or approval of shop details, the fact is recorded on the forms 7. This gives the order clerk an opportunity to reschedule the material to be delivered at the time the drawings go to the shops.

Occupants of Buildings Limited by Stair Capacity

The Committee on Safety to Life, of the National Fire Protection Association, presented at the recent annual meeting a report that was mainly devoted to an analysis of the safe occupancy of a building based on the capacity of the stairways. The report was accompanied by an elaborate table that gives the safe capacity of a floor under varying conditions of construction, sprinkler protection, protection of vertical openings, height and character of materials stored, manufactured or used. The committee based its tabulation on the principle that the maximum emptying time of a building is the determining factor in floor capacity, though with the average and better classes of buildings the number of persons allowed per floor should frankly be in excess of the capacity of the stairs and the stair inclosures. There was the further proviso that, in the poorer class of buildings or with highly combustible occupancies, only so many persons should be allowed on each floor as can safely escape by the stairs. The report was subject to a long discussion at the meeting and was finally accepted tentatively and allowed to go over one year for final adoption.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

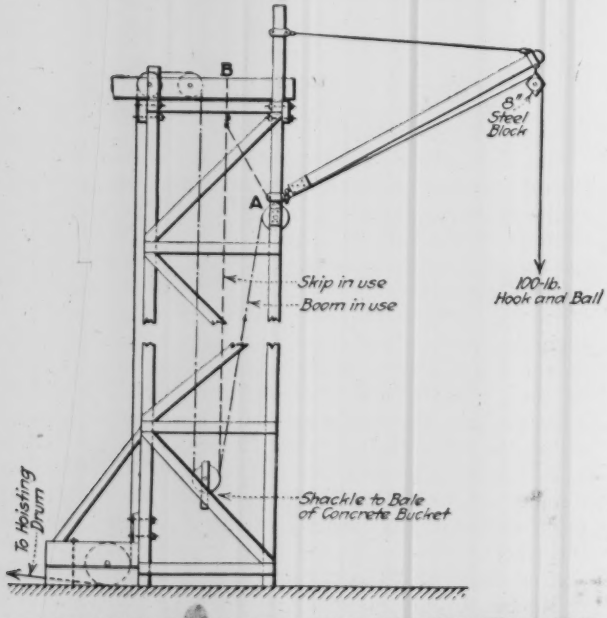
Block Down Concrete Bucket and Use Dead End of Fall To Work Tower Boom

By George E. Harr
Superintendent, Turner Construction Co., Newark, N. J.

OFTEN in reinforced-concrete building construction where a tower is used it is not possible for various reasons to install two hoists, and the same line is used both to handle the concrete bucket and the boom rigged on the tower for handling reinforcing. The principal drawback to this method is the length of time it takes to change the cable from the bucket to the boom and back again.

The scheme shown in the sketch, which was used by the writer on Colgate & Co.'s building G-1, built recently by the Turner Construction Co., of New York City, was to reave a single cable through the bucket and then through the boom, leaving it in this position all the time. When the boom was to be used, the bucket could be held down by sticking a 4 x 6-in. timber through the hoist tower. When the bucket had to be hoisted, a dead end was made in the line at the top of the tower by taking a bight in the cable at *A*, throwing a turn over the header block at *B* and fastening it with two clips. When this is done and the 4 x 6 block taken out of the base of the tower, the rigging is ready for hoisting concrete.

This change was frequently made in 10 min. and never took longer than 15 min. When changing the rig from hoisting concrete to shape for using the boom, one man takes off the cable slips and another puts the 4 x 6 over the bucket at the bottom of the tower. This operation never took more than 5 min. and once the change was made in two. This time is, of course, much less than that required for the old way of rigging and unrigging the boom or bucket for each change.

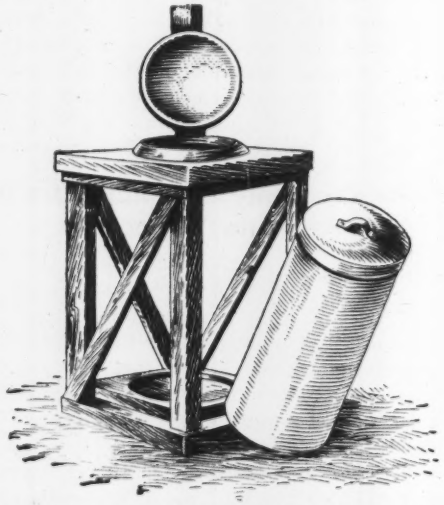


CAN CHANGE TOWER WITH THIS RIGGING FROM ELEVATOR TO DERRICK AND BACK IN 15 MINUTES

Sanitary Latrine Made from Carbide Cans and Thin Boards

By H. A. Sitterley
Chief Engineer, Low Moor Iron Co., Low Moor, Va.

A CONVENIENT, cheap and sanitary latrine that can be used in camp sanitation or on building construction before the plumbing is put in can be made from a carbide can set in a frame consisting of four 2 x 2-in. posts held together with eight ½ x 2-in. boards and braced by two ½ x 2-in. boards. One corner post is allowed to project up through the top, and serves as a handle—further serving to make the lid self-closing. A 100-lb. carbide can, resting on three ½ x 2½ in. cross-pieces, and held in place by a ¾-in. board cut out circularly so as to fit the bottom of the can, forms the latrine proper. The top of the frame, which forms the seat and cover, is removable and the frame is made just high enough to admit the carbide can, thus making the receptacle flyproof. A solution of 1 lb. of chloride of lime to 8 gal. of water is used as a disinfectant, costing only about 1c. per gal. This latrine was designed and constructed under the direction of Roy S. Bonsib, at that time superintendent of the Low Moor mine, and can be built at a cost, including labor and materials, of less than $3. This arrangement has been in use several years, and has always proved adequate to the conditions for which it was originally designed.

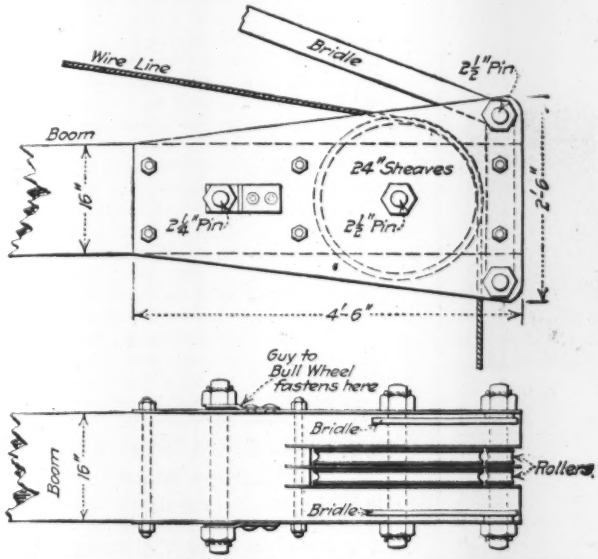


FLYPROOF AND PORTABLE, THIS LATRINE COSTS LESS THAN THREE DOLLARS

Lines Do Not Jump the Sheaves in This Boom End

By George W. McAlpin
Government Dam 39, Florence, Ind.

THE sketch shows a rigid boom end being used on the derrick boats at Government Dam 39 on the Ohio River. The inside plates shown aid in keeping the lines in the sheaves, and these boom points have proved very rigid and give excellent service. Five plates are used, two on either side of the stick, one between the boom and each sheave and one between the two sheaves.



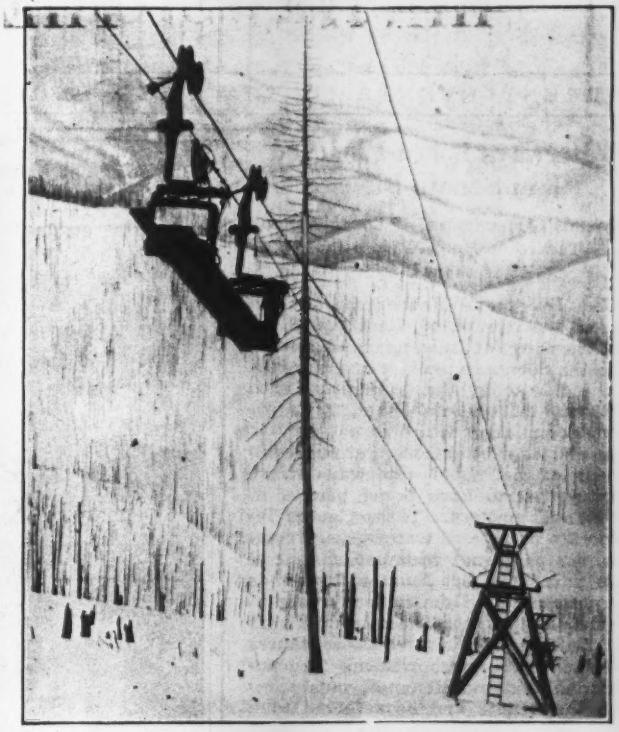
STRONG, RIGID BOOM POINT DOES NOT WEAR LINES

The sheaves, 24 in. in diameter, are set side by side and held by a 2½-in. pin passing through them and through all five plates. The bridle, holding the boom line, is attached by a 2½-in. pin to the upper outside corner. Small steel rollers, running on the bolt through the lower outside corner, prevent the lines from wearing.

Tramway Cable Transports and Erects Own Bents in 20 Feet of Snow

A MINE tramway about 8000 ft. long was erected near Adair, Idaho, by the Riblet Tramway Co., of Spokane, in the dead of winter with 20 ft. or more of snow on the ground by the expedient of stringing the main cable and using it with a special carrier to transport the bents. As fast as each bent was erected the main cable would be attached to it, raising it sufficiently to bring it clear of the snow at the site of the next bent. The total elapsed time of construction was 85 days.

The cable, which was built for the Richmond Copper Mining and Milling Co., was erected in snow ranging from 15 to 28 ft. in depth, which had to be shoveled out of the way at the site for each bent. A light line was first run from the engine at the bottom end of the line to the extreme upper end of the tramway, and passed around a sheave. This line was used to haul the first main cable to place, the large cable being anchored and stretched as tightly as possible. The first tower bent, which had been erected next to the engine, raised



CABLEWAY CARRIES MATERIAL TO BUILD ITSELF

this end of the cable sufficiently to clear the snow at the site of the next bent. Material for the second bent was then loaded on the special buggy shown in the photograph, carried to place and lowered with tackle, by which the carriers were hung from the buggy. The buggy could then return, pick up another set of loaded carriers, and take them to the bent at which work was going on.

As each bent was erected the main cable was slacked off from the bottom, raised to the top of the new bent, and tightened. Material was received at the lower terminal on the tramway near the engine house.

MAN IS POINTING AT 26-FT. BENT BURIED IN SNOW

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Waterways Board Proposed in Senate Bill

Newlands' Amendment of Long Standing Tacked on House Rivers and Harbors Bill

The Rivers and Harbors bill, which passed the House of Representatives the latter part of June, has been amended in the Senate committee and reported to the Senate by that committee with additional clauses establishing a Waterways Commission which is not only to plan and control the navigation development of the inland waterways of the country, but to have broad powers in all related matters. These clauses incorporate an idea of waterways, irrigation, drainage and reclamation control long advocated by Senator Newlands and presented by him in many bills to previous congresses. The present Rivers and Harbors bill, with the new clauses and the usual appropriations for construction and maintenance, must now pass the Senate and be referred to a conference of the two houses.

The Waterways Commission clauses are as follows:

"That a commission, to be known as the Waterways Commission, consisting of seven members to be appointed by the President of the United States, at least one of whom shall be chosen from the active or retired list of the Engineer Corps of the Army, at least one of whom shall be an expert hydraulic engineer from civil life, is hereby created and authorized, under such rules and regulations as it may adopt, to bring into coördination and coöperation the engineering, scientific and constructive services, bureaus, boards and commissions of the several governmental departments of the United States and commissions created by Congress that relate to study, development or control of waterways and water resources and subjects related thereto, or to the development and regulation of interstate and foreign commerce, with a view to uniting such services in investigating, with respect to all watersheds in the United States, questions relating to the development, improvement, regulation and control of navigation as a part of interstate and foreign commerce, including therein the related questions of irrigation, drainage, forestry, arid and swamp-land reclamation, clarification of streams, regulation of flow, control of floods, utilization of water power, prevention of soil erosion and waste, storage and conservation of water for agricultural, industrial, municipal and domestic uses, coöperation of railways and waterways, and promotion of terminal and transfer facilities, to secure the necessary data and to formulate and report to Congress as early as practicable a comprehensive plan or plans for the development of waterways and the water resources of the United States for the purposes of navigation and for every useful purpose, and recommendations for the modification or discontinuance of any project herein or heretofore adopted."

Salaries of $7500 each are provided for the commissioners and an appropriation of $100,000 made for the expenses which the commission may find itself obliged to mee[illegible]

In Charge of British Recruiting Western Division

LIEUT. COL. JOHN S. DENNIS

THE McLean Pipers, attached to the Overseas Battalion of St. John, N. B., and the brass band of the 48th (Gordon) Highlanders of Toronto are now in Chicago aiding the British Recruiting Mission, the Western Division of which is under the direction of Lieut. Col. John Stoughton Dennis, president of the Canadian Society of Civil Engineers. During the week of July 15 New York City had the pleasure of entertaining these units of our ally, and it is expected that other centers than Chicago may be stirred by the characteristic music of the "bags." It was through Colonel Dennis' efforts that these detachments were sent to this country.

Twenty-five New Engineer Regiments Created

War Department Authorizes Organization of Additional Engineer Units for Service at the Front

Announcement has just been made at Washington that the War Department has authorized the creation of additional engineer units, aggregating about 25 regiments. These troops will have charge of the engineering operations behind the lines and will be engaged on such work as railway operation, construction and repair (in which they supplement the nine railway regiments already recruited), water-supply, forestry and topography. It is probable that companies of laborers will be included, but the question of electrical units has not been settled.

The engineers will be mobilized at the divisional cantonments. Officers will be taken mainly from the engineer officers' training camps, then from the engineer officers' reserve and from engineers not yet in either service.

Both Goethals and Denman Out of Shipping Board

On July 24 the President accepted General Goethals' resignation as president and manager of the Emergency Fleet Corporation and at the same time asked for the resignation of William Denman as chairman and member of the United States Shipping Board. Mr. Denman immediately tendered his resignation. The resignation of John B. White from the Shipping Board was also accepted by the President. It was announced that the President would appoint Edward N. Hurley, late of the Federal Trade Commission, as chairman of the Shipping Board, and Bainbridge Colby, a New York lawyer, to succeed Mr. White. Admiral W. L. Capps, a well-known naval constructor, will be detailed to serve as head of the Emergency Fleet Corporation.

Samuel M. Felton To Head the Army Railways Abroad

Samuel M. Felton, M. Am. Soc. C. E., president of the Chicago Great Western R.R., has been made director general of the railways abroad, in which capacity he will have charge of all the railway work done by the American Army in France. Mr. Felton is a civil engineer by education and training and has had long experience in railway construction and management. He was the railway adviser to the army in the Mexican expedition of last year and in the organization of the nine railway regiments.

Railways Must Pay Cost of Bridge Upkeep

St. Paul Wins Suit in State Supreme Court Affecting Street and Steam Railways

EDITORIAL CORRESPONDENCE

Court decisions and admissions by various railway companies have established the right of the City of St. Paul to make both street and steam railways pay for all bridge repairs and maintenance where bridges are necessary to maintain uninterrupted street traffic over their tracks.

An ordinance passed in December, 1913, by the City Council directed the St. Paul City Railway Co. to build and operate a line on Dale St. over a bridge crossing the Great Northern Ry. tracks, and the railroad was ordered to strengthen the bridge. The company refused to comply with the ordinance, and the bridge was strengthened by the city, which then brought suit in the Ramsey County District Court for $13,-047.

The district court denied the city's claim for $10,392, but awarded damages against the railroad company for $2655 for general repairs, on the grounds that the bridge having been erected in 1890 and the city and the St. Paul City Railway Co. having made an agreement that the city should strengthen the bridge it would not be fair to force the railroad company to pay that cost.

The State Supreme Court has just reversed the decision of the district court compelling the railroad company to pay the cost. This court held "That the use of a street for street-railway traffic is a public use in aid of public travel and that, when the use of a street for a street-railway line becomes appropriate, it is the duty of the railroad company to strengthen the bridge and make it fit for such use."

The Chicago Great Western R.R. has settled, without trial, in the Federal District Court, a suit brought against it by the city for $5000 for repairs to the Robert St. bridge over its tracks, and the Ramsey County District Court has upheld the city in its suit for $7000 against the Omaha Ry. and Great Northern Ry. for repairs made on the Westminster St. bridge.

Court Holds Up $250,000 Paving Work at Montclair, N. J.

The lowest bidder for paving some four miles of streets in Montclair, N. J., has secured an order from the Supreme Court at Newark, returnable July 30, requiring the Town Commission to show cause why a writ of certiorari should not be issued to review the award to a higher bidder made on July 17. On the day just named the commission awarded a contract for paving Park St. for $197,854 and Bellevue Ave. for $45,408 to the Standard Bitulithic Co., the material to be "warrenite." A bid $18,212 lower, to pave the same streets with a bituminous pavement in accordance with the "Topeka specifications," was submitted by Chapman, Harrop & Lawrence, who allege that the commission did not award the contracts to the lowest bidders under the ordinances authorizing the work. These ordinances, it is stated, called for bids on several kinds of pavements.

The Town Commission states that in awarding the contract to other than the lowest bidder it acted for what it believed was the best good of the town.

Why City Engineer Was Thrown Out of Office

Excuses in Statement by Los Angeles Board of Public Works—Real Reason Illustrated by Letter by City Engineer

VAGUE excuses for removing Homer Hamlin from office as city engineer of Los Angeles, Calif., are given in the announcement of the removal by the Board of Public Works, printed below. A letter from Mr. Hamlin calling the attention of the board to its own deficiencies illustrates why there has been an "entire lack of harmony between the board and the city engineer."

EXCUSES AND GENERALITIES OF THE BOARD

The board's statement of its reasons for removing Mr. Hamlin on July 16, signed by Lorin A. Handley, president, P. P. O'Brien and Owen M'Aleer, follows:

"The Board of Public Works has this day declared vacant the office of the city engineer. It was with regret that we were brought to this situation. The board gave Mr. Hamlin ample opportunity to resign and desired him to leave the city's service in that manner, but his positive refusal compelled the board to take this action.

"The board wishes Mr. Hamlin well. We recognize that he gave the city much valuable service during the past years. However, we were convinced that the time had come for a change. The administration of the office has long been under severe criticism. Members of the board have conferred with the engineer, individually and collectively, to seek some remedy for this situation, but no progress could be made.

"In recent months there has been an entire lack of harmony between the engineer and the members of the board. Efforts on the part of members of this body to bring about a more amicable understanding have been of no avail. Therefore it was impossible to continue this condition any longer.

NOT A SUDDEN IMPULSE

"This action is taken upon no sudden impulse. For some time the board has been carefully considering what should be done in the interest of the city, and after every angle had been considered and every problem was thoroughly weighed, the board felt that duty to the city compelled it to take the action of this day."

In marked contrast to the vague general allegations of the board against Mr. Hamlin is the following crisp, specific letter from Mr. Hamlin calling the board's attention to the failure of some oiled macadam accepted by the board and the City Council in spite of the city engineer's refusal to issue a certificate of acceptance:

"I desire to call your attention to the fact that the oiled macadam pavement on Malabar St., which was accepted on Jan. 4, 1917, over my objections, is already failing and disintegrating in many places throughout the length of this improvement.

REFUSED TO ACCEPT POOR WORK

"Your records will show that I refused to issue a certificate of acceptance on this work on the ground that it was not constructed according to the specifications and particularly that the rock provided by the contractor was unsuitable and unfit and would not compact under rolling.

"Despite my objections your honorable body referred my report to the City Council, with the recommendation that said work be accepted, and upon such recommendation the Council did accept the same.

"It was the opinion of the board, as I understand it, that my inspection was too severe in this case, and that my apprehensions as to the lasting quality of the work were unfounded.

"Unfortunately for the property owners who were required to meet the expense of this improvement, costing more than $11,000, the results prove that my objections and apprehensions were fully justified in this case. The taxpayers of the city also are affected by this defective work because of the increased expense of repairing and maintaining the street.

"It would seem to be consistent with justness and fairness that the contractor on this work, who was daily advised while it was in progress that he was not conforming to the specifications, should be required, if legally possible, to reconstruct the work and put it in condition to meet the requirements of the specifications."

Constructing 455 Buildings at Leon Springs, Texas

A complete sewage-disposal system, lighting system with generating plant and water-works system supplied from wells constitute the utilities for the mobilization camp at Leon Springs, near San Antonio, Tex. The 455 buildings so far authorized in the cantonment will house four regiments of field artillery, one regiment of infantry, one regiment of engineers, two battalions of signal corps and a signal officers' training camp. J. H. Frederickson is superintendent for James Stewart & Co., contractors.

Take Stock of Available Road Materials

Interstate Committee To Investigate Suitable Deposits—Nineteen States Represented

An interstate stocktaking of road materials is now under way, with Dr. William Bullock Clark, state geologist of Maryland, in general charge of the geological work, and Henry G. Shirley, chief engineer of the State Roads Commission of Maryland, directing the engineering work. This undertaking is part of the work of the National Research Council, organized by the National Academy of Sciences at the request of President Wilson to assist the Council of National Defense. The committee which is investigating road materials is known as the Committee on Available Materials for Rapid Railroad, Highway and Fortification Construction Behind the Front. Its investigations are being conducted along the Atlantic and Gulf Coasts with the aid of the geologists of the different states and the state highway departments. The members of the committee are:

Alabama—Prof. E. A. Smith, University; W. S. Keller, state highway engineer, Montgomery.

Connecticut—Prof. H. E. Gregory, New Haven; C. J. Bennett, state highway commissioner, Hartford.

Delaware—Dr. E. B. Mathews, Johns Hopkins University, Baltimore; James Wilson, highway commissioner, Wilmington.

Florida—Dr. E. H. Selards, Tallahassee; W. F. Cocke, state highway commissioner, Tallahassee.

Georgia—Prof. S. W. McCallie, Atlanta; T. P. Stanley, state highway engineer, Athens.

Louisiana—Prof. F. V. Emerson, Baton Rouge; W. E. Atkinson, state engineer, New Orleans.

Maine—Dr. H. P. Little, Waterville; Prof. W. E. Ford, New Haven, Conn.; Paul D. Sargent, chief engineer, state highway commission, Augusta.

Maryland — Dr William Bullock Clark, Baltimore; H. G. Shirley, chief engineer, State Roads Commission, Baltimore.

Massachusetts—Prof. B. K. Emerson, Amherst; Arthur W. Dean, chief engineer, State Highway Commission, Boston.

Mississippi—E. N. Lowe, Jackson; Xavier A. Kramer, state highway engineer, Magnolia.

New Hampshire—Dr. J. W. Goldthwaite, Hanover; F. E. Everett, state highway commissioner, Concord.

New Jersey—Dr. H. B. Kummel, Trenton; R. A. Meeker, state highway engineer, Trenton.

New York—Dr. C. P. Berkey, New York; E. A. Duffey, state highway commissioner, Albany.

North Carolina—Dr. Joseph Hyde Pratt, Chapel Hill; W. S. Fallis, state highway engineer, Raleigh.

Pennsylvania—Dr. R. A. F. Penrose, Jr., Philadelphia; W. D. Uhler, chief engineer, State Highway Department, Harrisburg.

Rhode Island—Dr. Charles W. Brown, Providence; I. W. Patterson, chief engineer, State Board of Public Roads, Providence.

South Carolina—Prof. Stephen Taber, Columbia; J. Roy Pennell, state highway engineer, Columbia.

Virginia—Dr. Thomas L. Watson, Charlottesville; G. P. Coleman, state highway commissioner, Richmond.

Texas—Prof. J. Udden, Austin; Prof. R. L. Morrison, College Station.

Boston Engineers Reinstated

Following the decision of the full bench of the Massachusetts Supreme Court (*Engineering News-Record*, July 12, 1917, p. 93), the three employees of the Department of Public Works of Boston who were removed from office early in 1916 for political reasons have been reinstated. They will receive their old salaries for the time they were off the payroll, less whatever they have earned otherwise meanwhile. Storrs L. Durkee, supervisor of permits, has returned to city work. Bliss W. Robinson, superintendent main drainage works, will continue until Sept. 1 in charge of repairs of the German steamer "Koln" for the United States Government. Frank A. McInnes, engineer sewer and water division, will remain on private work in Nova Scotia until Sept. 1. Of the 14 other men discharged, all save Dr. Arthur H. Davison, examining physician, were restored to the municipal payroll last year, not having taken their discharge to court.

Standards Bureau To Test Cement for Reclamation Service

In accordance with a memorandum agreement between A. P. Davis, director of the United States Reclamation Service, and S. W. Stratton, director of the Bureau of Standards, the work conducted in the laboratories of the Reclamation Service at Denver, Colo., and San Francisco, Calif. is to be taken over by the Bureau of Standards. The personnel and equipment of these laboratories are to be transferred to the Bureau of Standards and maintained substantially as at present. Orders for cement shipments and inspection will be sent by the office of the chief of construction to the Denver office of the Bureau of Standards. Records of tests and inspection will be kept by the Bureau of Standards and will be available for examination by the Reclamation Service.

The Bureau of Standards will also make tests and analyses of concrete and concrete aggregates, chemical analyses of water and soils, and other tests and analyses required by the Reclamation Service. Pending the final provision for the complete maintenance of these laboratories by the Bureau of Standards, the necessary funds are to be supplied from the appropriation for the work of the Reclamation Service.

Headquarters at Menlo Park for 19th N. G. Division

Campsite for 30,000 Men Now Being Laid Out 30 Miles South of San Francisco

The camp site which will be headquarters for the 19th National Guard division has been located near the Town of Menlo Park, on the Southern Pacific, about 30 miles south of San Francisco. Leases have been drawn up for the "period of the war," and the engineers were at work on the site the second week in July.

Although the site is near the double-track line of the Southern Pacific, complete independent terminal facilities are being laid out at the camp in order to handle the large number of special trains and the freight they will transport. The first troops are expected to reach the encampment by the second week in August. Meantime, construction will be rushed so as to have everything in readiness. It is estimated that about 2,000,000 ft. Bm. of lumber will be used in the construction plan, as well as large quantities of electrical and railway supplies. Other Pacific Coast encampments are at Linda Vista, near San Diego, Calif., and American Lake, near Seattle, Wash.

Larger Force for Patent Office

A bill now before the House of Representatives provides for additional examiners in the United States Patent Office, as follows: Two principal examiners, at $2700 a year each; one examiner of interferences, at $2700 a year; four first assistant examiners, at $2400 a year each; four second assistant examiners, at $2100 a year each; four third assistant examiners, at $1800 a year each, and four fourth assistant examiners, at $1500 a year each.

St. Paul Office of U. S. Geological Survey Is Discontinued

The St. Paul office of the Water Resources Branch of the United States Geological Survey, located in the Old Capitol Building, was discontinued on July 7, 1917. This office, established during June, 1909, has been maintained in coöperation with the State Drainage Commission, of which E. V. Willard is state drainage engineer. S. B. Soule, who has been in active charge of the survey office for the past three years, has been transferred to the Denver offices of the survey. The Minnesota work in the future will be handled from the Madison office, under the direct charge of W. G. Hoyt, district engineer for the Upper Mississippi District.

During the time the St. Paul office has been in existence, hundreds of miles of rivers have been surveyed, and gaging stations have been maintained on all the principal rivers of the state. The data which were collected have been published in state reports of the water resources of Minnesota and also in various Water-Supply Papers of the United States Geological Survey.

Detroit Adopts Merit System for Sewer Inspectors

Recognizes That Service Requires Trained and Qualified Men—Provide Wage Scale

EDITORIAL CORRESPONDENCE

The Detroit City Council, acting on the recommendation of City Engineer Clarence W. Hubbell, has adopted a system for grading and promoting inspectors on sewer construction. Inspectors have been paid a flat rate of $4 per day, regardless of length of service or ability, and as a rule inspectorships have been passed out as rewards for political service. The new system is the first step in an attempt to raise the standard of inspectors, in recognition of the fact that such service is an important part of the work of the engineer's office and one requiring trained and qualified men.

New appointees shall receive $3.50 per day during a probation period of 60 days. At the expiration of this probation period, these inspectors, if retained in the service, shall be advanced to $4 per day. Inspectors advanced to $4 per day shall continue at this rate for one year. At the expiration of such term of service, if the service record of the inspector shows a rating of 80% or more, the inspector shall be advanced to $4.50 per day. All inspectors in the service of the city as inspectors on July 1, 1916, are increased from $4 per day to $4.50 per day. At the end of each fiscal year all inspectors who have received $4.50 per day for nine months or more and whose service record for one year shows a rating of 90% or more shall be advanced to a salary of $1440 per year.

SERVICE RATING WILL BE KEPT

The service record or rating will be made by the city engineer monthly, and the ratings will be based on three main divisions, namely: (1) Reliability, which includes punctuality, regularity and deportment; (2) workmanship, which comprises the broad field of enforcement of specifications, and (3) special duties, referring particularly to attention to lines and grades, completeness and accuracy of daily reports and other records.

Another departure from long-standing custom is the manner of paying inspectors. Formerly inspectors were paid weekly in cash at the paymaster's office in the City Hall. This method required that the inspector leave his work for a period varying from two hours to the greater portion of a day, depending upon the distance of the work from the City Hall and the reliability of the inspector. During the absence of the inspector from the work the contractor proceeded with the work of construction as he saw fit, and the custom supplied a very convenient alibi for the inspector for absence on pay day.

A logical conclusion was that, if the services of the inspector were not needed on the work for one day out of each week, his services were of little value and might well be dispensed with entirely, or that the system was at fault. Obviously, the latter was the correct finding. Consequently, hereafter the inspector will be paid by check. At first the checks will be delivered on the job each week; but it is the present purpose of the city engineer to extend the period of payment to two weeks and deliver the checks through the mail.

Causes of Failure of Mammoth Dam as Given by State Engineer

The failure of the Mammoth dam of the Price River Irrigation Co., Utah, on June 24-25, was due to the following causes, according to a report by George F. McGonagle, state engineer:

"This dam failed, (1) because the flume portion of the spillway was improperly and inadequately constructed; (2) because the horizontal reinforcement of the corewall had been stopped 12 ft. above the base instead of being carried to the top of the core; (3) the first section of the corewall to fall sheared off at a point 5 ft. below the top, indicating that the bond between the older section of the wall and the 5-ft. raise made last year was not what it should have been; (4) because the management deliberately permitted the level of the water in the reservoir to rise to within 10 in. of the top of the core, contrary to all precedent."

Los Angeles Aqueduct Has Two More Breaks

Earthquake Damage July 7 Followed by Unexplained Breaks July 15 Repaired July 27

An earthquake in the Owens Valley, California, early on July 7, caused a landslide that carried away about 160 ft. of the Los Angeles aqueduct 26 miles above the Haiwee reservoir. At this point the aqueduct is an open concrete flume. The break was located almost immediately and was quickly repaired with riveted steel pipe. Meantime the Haiwee reservoir maintained service.

On the morning of July 15 two breaks were discovered in the aqueduct, one 81 miles from Los Angeles, near Neenac, and the other 165 miles north of Los Angeles, in the Soda Springs tunnel. These breaks are below Haiwee reservoir and each is about 150 ft. below a standard 3 x 3-ft. manhole.

At the Neenac break, where the flow is through covered conduit, the bottom was taken out cleanly for about 70 ft. The walls and cover, which were left standing in place, showed no cracks. In clearing for temporary closure the concrete was found in excellent condition. Within three hours after the break 75 men were at work upon it preparing to install a 9-ft. steel pipe. This work was completed and the line in service again on July 22.

In the tunnel break the water was drained from the upstream side by reopening an adit used during construction. It was then found that about 100 ft. of the tunnel was closed at the top by débris from above. The repairs consisted of removing this material and blocking up the roof. The reservoirs below the break had sufficient water in storage to maintain domestic service in Los Angeles and the shut-off of irrigation water usually supplied San Fernando Valley has not resulted in damage to crops as yet. It is expected that the tunnel will be in service about July 27.

The flow in the conduit at the time of the breaks was about 300 sec.-ft. The cause of the breaks has not been ascertained. Suspicious circumstances are being investigated.

Louisville Cantonment Nearing Completion

MAP OF THIS CANTONMENT IS SHOWN ON P. 154 OF THIS ISSUE

National Guard Cantonment Contracts Awarded

The following contracts have been approved by the Secretary of War for National Guard mobilization camps: Augusta, Ga., O. Brown, Augusta, Ga.; Alexandria, La., Stewart-McGehee Construction Co., Little Rock, Ark.; Macon, Ga., W. Z. Williams, Macon, Ga.; Houston, Tex., American Construction Co., Houston, Tex.; Spartanburg, S. C., Fisk-Carter Construction Co., Greenville, S. C.; Fort Sill, Okla., Selden-Breck Construction Co., St. Louis, Mo.; Waco, Tex., Fred A. Jones Construction Co., Dallas, Tex.; and Greenville, S. C., Gallivan Building Co., Greenville, South Carolina.

Liable for Light Shut Off by Street Shaft

Carrying Out of Subway Work Is Held To Lay Contractor Open to Damages for Temporary Interference

If the decision handed down by Judge Dowling, in the Appellate Division of the New York Supreme Court, is sustained by the Court of Appeals, a subway contractor will have to pay damages to a property owner because of inconvenience suffered by the latter as a result of the carrying out according to accepted plans of the new subway construction in New York City. It is stated, however, that in the event Judge Dowling's view is upheld, the contractors are confident of recovering the damages from the city. The decision is considered very sweeping and will, it is said, open a way to an endless tangle. It has always been held heretofore, and the subway construction, as well as other public improvements, has been carried out on the theory, that private rights must yield to temporary inconvenience and loss arising from acts done in the public interest and under legislative authority. Under this theory damages suffered by abutting property owners as a result of the proper carrying out of public works could not be collected.

The only exceptions, it is believed, are the famous Joralemon St. cases and an instance in which the city, in dredging for a dock, cut off all access to abutting property for two years. The settlement occasioned by the Joralemon St. work, however, was in the nature of a permanent damage, although the subway tunneling which caused it was of temporary duration.

Judge Dowling's opinion, however, holds specifically that the subway work is not public work carried out in the public interest under legislative authority, but that it is proprietary in its nature, the city being in the same situation as a private corporation such as a railroad. Since it has been held that a railroad can be made to pay damages for temporary interference with rights of light, air and access, the judge therefore decided that the contractor, as agent of the city, can also be held liable for such interference.

Decision Expected To Work Great Injustice

The contractors for New York subway work are said to hold that, regardless of the constitutional and legal aspects of the question, it is a manifest injustice for them to be held liable for such damages when it was the universal opinion at the time the work was undertaken that such damages could not legally arise, the city having the right to carry out public work at necessary inconvenience of a temporary character to abutting property owners. Had it been held otherwise, they point out, it would have been necessary for the city to negotiate temporary easements with property owners all along the line of the proposed subway, just as in the case of permanent easements where the subway structure itself occupies or interferes with private property, before any contractor could be induced to bid on the work. Such a course would, it is further pointed out, prove very tedious and expensive to the public, as this sort of temporary interference could not be accurately foretold, and any property owner who could not reach an agreement with the city as to the terms on which he would forego claims to future damage might hold up the entire work. The contractors hope that the court will ultimately compel the city to reimburse them for all claims allowed. Otherwise, many of them might be bankrupted, as it is reported that property owners are waiting on this decision to bring actions for hundreds of thousands of dollars against various subway contractors.

Even should these damages ultimately be collected from the city, the contractors expect to have any profits they may have made on the subway work, and probably much of their capital as well, tied up in lawsuits for many months.

Present Colors to First Regiment Illinois Engineers

The Western Society of Engineers' board of directors held a meeting on July 9 and unanimously decided that the society present to the First Regiment, Illinois Engineers, the national and regimental colors. This regiment is now and will continue to be a permanent unit of the Illinois National Guard. It has been organized and recruited by the Citizens' Unit and includes many members of the society.

Akron Leases Its Municipal Garbage-Reduction Works

Owing to difficulties with its garbage-collection contract, the City of Akron, Ohio, has leased its municipally owned garbage-reduction works, which were put in operation Jan. 1, 1916. The garbage-collection contract, which took effect at the same time, provided that the city would pay the collector $3.12 a ton for garbage delivered to the works. The city, according to C. F. Beck, director of public service, found private collection unsatisfactory. The contractor threw up the work after six months. A second contractor also lost money and notified the city that it was about to throw up the contract. The city made arrangements for collection by direct labor, but was prevented from doing this by the financial condition common to Ohio cities of late. An arrangement was then made under which the city pays the collection company $3.12 per ton of garbage delivered to the reduction works and the company leases the works for five years, with an option of a five-year renewal, at a price equal to the interest and sinking-fund charges on the reduction works. Mr. Beck states that the scarcity of labor and the high cost of living in Akron have been contributing factors.

Personal Notes

J. C. Beckwith, engineer of construction on the Canadian Government Railways, has been appointed division engineer, with headquarters in Moncton, N. B., succeeding H. T. Ruhl, who resigned to accept service with another company. A. V. Redmond, resident engineer at Cochrane, Ont., has been appointed division engineer, with the same headquarters, succeeding W. A. Cowan, promoted. A. H. Willett, assistant division engineer, with headquarters at Cochrane, Ont., has been appointed resident engineer, with the same headquarters, succeeding A. V. Redmond.

The Pennsylvania R.R. system has furloughed the following officers during the period of their service with the Ninth Engineers, National Army:

H. H. Maxfield, superintendent of motive power, New Jersey Division, Jersey City, N. J., who becomes Lieutenant-Colonel; B. D. Barrett, master mechanic, Williamsport Division, Sunbury, Penn., and D. S. Gaskill, master mechanic, Baltimore Division, Orangeville, Md., who become Majors, and F. S. Robbins, assistant mechanic, Pittsburgh Division, Pittsburgh, Penn., who becomes captain. The following appointments have been made to fill the places of the men above furloughed: F. G. Grimshaw, assistant engineer of electrical equipment, Philadelphia Terminal Division, to be superintendent of motive power, New Jersey Division; R. G. Bennett, assistant engineer of motive power, Central Division, who succeeds Mr. Barrett at Sunbury; G. H. Watkins, assistant engineer of motive power, Western Penn. Division, who succeeds Mr. Gaskill at Orangeville; and J. H. Thomas, assistant general foreman, Pitcairn Shop, who succeeds Mr. Robbins at Pittsburgh. These promotions were effective July 1, 1917.

W. D. Warren has been appointed maintenance engineer of lines East, New York, New Haven & Hartford R.R., with offices at Boston, Mass. Mr. Warren began railway work with the Boston & Maine R.R., and later served on the Pennsylvania Lines. In 1903 he became connected with the New York, New Haven & Hartford R.R., and then served consecutively on the New York Central as chief of party and on the Florida East Coast Ry. as resident engineer. He returned to the service of the New Haven in 1907 as division engineer of valuation, later becoming division engineer of the Provincetown division, which position he held at the time of his recent appointment.

F. B. TAPLEY, assistant engineer of the Canadian Government Ry. at Moncton, N. B., has been appointed assistant engineer of maintenance.

FRANK H. CROCKARD, vice president and general manager in charge of operations, Tennessee Coal, Iron and Railroad Co., since 1906, has been made president of the Nova Scotia Steel and Coal Co. A special student at Lehigh University and Michigan College of Mines, all of Mr. Crockard's experience has been in connection with the steel and iron industry, he having constructed blast furnaces, rolling mills, openhearth plants, including tilting furnaces, and has developed red-ore mines and water-supply systems.

CHESTER F. LEWIS, who was employed by the Massachusetts Highway Commission during the summer of 1916 and served as assistant in the department of civil and sanitary engineering of the Massachusetts Institute of Technology, has accepted a position in the Office of Public Roads and Rural Engineering under H. K. BISHOP, engineer of District No. 10.

A. KEITH GOWANS, formerly assistant in the county engineer's office, Woodbury County, Iowa, is at present in charge of the sewer system at Wessington Springs, S. D. This work is being constructed by the Dakota Engineering Co., of Mitchell, S. D., for which Mr. Gowans is acting as resident engineer.

W. S. WOLFE, who for the past three years has been instructor in architectural engineering at the University of Illinois, is at present working for SMITH, HINCHMAN & GRYLLS, architects and engineers, on the design of structural steel and reinforced concrete.

GILBERT G. JACOBOSKY, consulting civil engineer, of Wilkes-Barre, Penn., has accepted a commission as captain, Battery F, Third Field Artillery.

ROBERT H. DOWNMAN, chairman of the lumber committee of the Council of National Defense, was elected president of the National Lumber Manufacturers Association, June 20, at the annual meeting of the directors in Washington. E. A. STERLING, who developed and managed the trade extension department, resigns, but R S. KELLOGG, the secretary-manager, states that more engineering work than formerly will be undertaken.

PROF. SELSKAR M. GUNN, director of the Division of Hygiene, Massachusetts State Health Department, has been appointed a member of the Commission for the Prevention of Tuberculosis in France, which will be headed by DR. LIVINGSTON FARRAND. Graduating from the Boston Institute of Technology in 1905, Professor Gunn became bacteriologist of the Boston Biochemical Laboratory, and in 1906 bacteriologist of the State Board of Health. From 1908 to 1910 he was health officer of Orange, N. J., and was sanitary expert of the Bureau of Economy and Efficiency, Milwaukee, in 1911. Professor Gunn is secretary of the American Public Health Association, editor of the *American Journal of Public Health*, and assistant secretary general of the 15th International Congress on Hygiene and Demography in 1912.

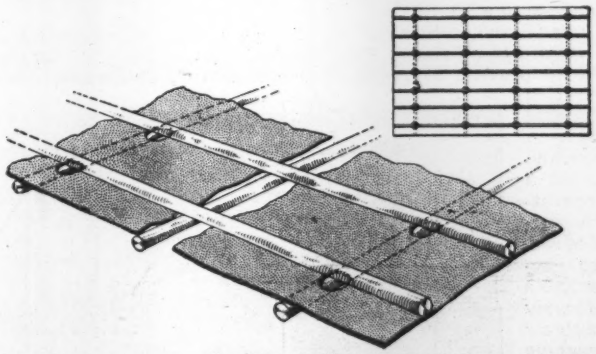
LEWIS T. CHURCHILL is now superintendent for the Joseph F. Burke Co., contractors, Plainfield, N. J., in charge of storm sewer construction and concrete pavements in Lakewood, N. J. Mr. Churchill has designed and constructed sewers and paving work in various points in New Jersey for the past 13 years.

APPLIANCES AND MATERIALS

Tarred Felt Between Welded Mesh Makes Excellent Sheathing

Clinton Welded Sheathing possesses advantages as an inexpensive support for all kinds of plastering and a light reinforcement for concrete floors and roofs. The material is manufactured by arranging longitudinal and transverse wires on opposite sides of a sheet of tarred felt and electrically welding them together through small holes previously punched in the felt at each point where a longitudinal crosses a transverse wire. In this way the tarred felt becomes an integral part of the wire mesh, being securely locked and held between the two groups of wires, but at the same time having no physical connection to any of the wires.

This material is made in stock grades of galvanized longitudinal wires of No. 13 gage, spaced 3 in. apart and cross-welded to No. 13 galvanized transverse wires spaced 8 in. apart. The material is furnished in flat sheets 32 in. wide and about 8 ft. long, packed in bundles of 50 sheets and crated for shipment. Heavier wires and sheets of special size may be obtained upon special order, but the wire spacing will be the same in all cases. The use of this sheathing effects a saving in plaster as compared with the amount required on other types of metal lath. In addition to this saving there is also a marked economy in plastering on this material, owing to the speed with which the plaster may be applied. It has been found that plaster laid on this sheathing is not only structurally strong, as a result of its peculiar reinforcement, but is unusually hard, due to the fact that the plaster has a greater density as a result of the greater pressure that may be applied. Fire and water tests have been made by Columbia University and by the Bureau of Standards on this material, and it has passed with perfect rating. It has been approved by the Building Department of New York City and every borough of Greater New York for use in fireproof and fire-resisting construction.



TARRED FELT HELD BETWEEN WELDED WIRES MAKES CHEAP SHEATHING

Patents Stone, Sand and Asphalt Distributing Machines

To reduce the labor element in macadam roadwork to a minimum, J. A. Johnson, division engineer of the Massachusetts State Highway Commission at Springfield, Mass., has developed and patented a mechanical stone and gravel spreader, to work in combination with a bitumen-spraying truck. Some experimental machines are already under construction, and it is hoped they will materially cut the cost of several elements in bituminous construction and maintenance.

The stone spreader attached to a bitumen-distributing motor truck is shown in Fig. 1. In construction and operation this device is a counterpart of the well-known manure spreader, universally used in farmwork. In fact, successful experiments with a manure spreader for spreading small stone are what led to the development of the stronger and more durable machines now under construction.

FIG. 1

FIG. 2

DISTRIBUTES ASPHALT AND COVERS IT WITH STONE—MAKES AND LAYS TAR GROUT

A modification of the same device is the sand-bitumen grouting machine shown in Fig. 2. This is intended for constructing a type of pavement much used in England and quite extensively experimented with in Massachusetts—a tar-grouted broken stone. The great difficulty with this construction is making and applying the tar grout before it separates. In the machine designed by Mr. Johnson the sand is ejected into converging sprays of bitumen, thus making a grout mixture.

Cast-Iron Water-Meter Housing with Square Top

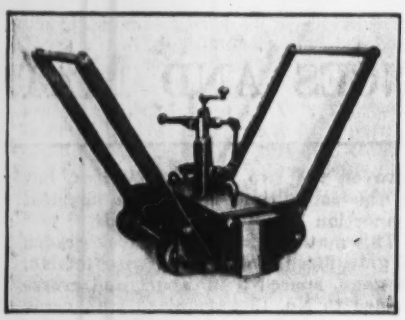
A cast-iron water-meter housing with a square top and a round base which fits a tile of vitrified clay or concrete measuring 18 in. in diameter inside, is being put on the market by the Modern Iron Works, of Quincy, Ill. The projecting square portion of the housing is of such a height that connection with adjoining brick or concrete pavement is made easily, and enough soil is carried above the flange to allow of a healthy growth of grass. No hammer, screwdriver, pick or shovel is necessary to open the top—a mere turn on the galvanized iron nut with a special key raises the cover almost half an inch. This is a great advantage when it is necessary to read meters after a sleet or rainstorm in freezing weather.

METER HOUSING HAS ROOMY RECTANGULAR THROAT AND IS EASILY OPENED

The housing is furnished either with or without an inner lid. With the inner lid an air-cell compartment between the outside and the inside is formed, thus making an excellent insulation against extremely low exterior temperatures. While the housing is made in only one size in order to reduce manufacturing cost, special designs conforming to any individual specification will be made without extra charge when 25 or more sets are ordered.

Bender for Ship Frames Weighs Only 750 Pounds

The Watson Stillman Co., 58 Church St., New York, has brought out a new tool for use in shipbuilding, designed to bend heavy steel shapes for ship frames, deck beams, etc. It is a very compact machine—built as light as is consistent with the work it is intended to do—consisting of a cylinder, ram and operating valve, mounted upon broad rollers so that it may be moved quickly over the bending slabs by handles at either side of the machine. It is thus possible to bend long members to templet, without reheating and with a minimum of labor.



WEIGHS 750 POUNDS—EXERTS 20 TONS PRESSURE

A loose pin is provided which fits into the holes in the bending slabs and serves as an abutment for the machine. The ram is double-acting, and its movement both forward and returning is under perfect control at all times. Provision is made to prevent overstroke. The illustration shows the machine equipped with a screw stem stop and release valve, but a single lever operating valve can be furnished if desired. Power may be supplied from a suitable pump, or preferably from an accumulator service. The machine is built as shown, with a movement at right angles to the axis of the ram, or in a direction parallel to it.

The machine illustrated has a 10-in. stroke and develops 18 tons at 1500 lb. per sq.in. and 20 tons at 1750 lb. per sq.in. pressure. It weighs 750 pounds.

National Catalog Numbering and Filing System Is Introduced

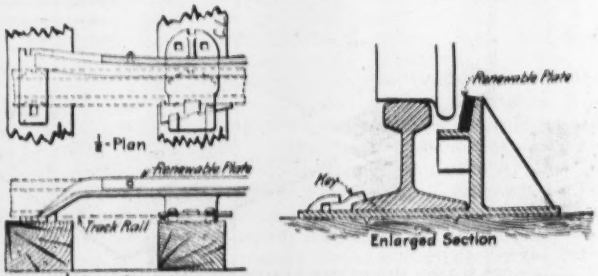
A national scheme for numbering all trade catalogs and loose-leaf bulletins is being promoted by the Catalog Numbering System, 338 Pine St., San Francisco. This concern has undertaken to maintain a central register office where numbers are assigned to any catalog or group of existing or proposed catalogs. These numbers are planned not to exceed six digits, but are used with letters as needed. Numbers are selected according to size, thickness, shape and binding of catalogs and not according to contents. Thus when any publications so numbered are filed in numerical order, the files will show an orderly size distribution. Index cards for the catalog are to be issued with the catalogs by the manufacturer—one displaying first the company's name and each of the others some article described in the catalog. The charge is $1 per number issued.

Frog Guard Rail Has Renewable Wearing Surface

A renewable wearing surface for guard rails for use at frogs is shown in the accompanying illustration. A casting 4 ft. long forms the guard rail and also three baseplates that carry the track rail, and has at each end a flange that forms a footguard. The inner face of the guard rail is recessed to receive a wearing plate of hardened steel, secured by countersunk bolts. This plate is reversible; and when both sides are worn, it can be renewed without disturbing the guard rail.

The middle baseplate has lugs on the inner end, and a horizontal taper key or wedge is driven between these and the base of the track rail. A spike driven at the back of this key prevents it from working loose. Ordinary spikes are used in the end baseplates. Teeth under all the plates grip the tie and prevent slipping.

This guard rail weighs 80 lb. It is manufactured by the National Steel Products Co., of Ensley, Alabama.



GUARD RAIL HAS RENEWABLE WEARING FACE